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GERMAN TRADE IN 1913.

IT is impossible to say that the principal industries in Germany experienced an unfavourable course of trade when 1913 is regarded as a whole from the standpoint of the volume of work carried out, although the amount of new business transacted in certain trades declined especially in the second half of the year, and prices in some departments also fell onwards from the beginning of April. An examination of the subject has to be prefaced by the consideration that a few branches, particularly in the case of raw or semi-finished materials, are entirely in the hands of legally binding syndicates which control both production and prices, and, as a consequence, those materials or products which are regulated in this manner ensure greater stability in prices to those who are directly interested, than those manufactures which are not subject to any trade combination. As matters now stand, the coal industry is dominated by the Rhenish-Westphalian Coal Syndicate in the West and in certain other parts of the country, and by a similar syndicate in Upper Silesia, while the South-Western district is held mainly by the Prussian State mines in the region of the S'aar, whose sale prices to the public, as a rule, are higher than those charged by private enterprise and whose miners receive lower wages than those paid by the private collieries in Westphalia. The Westphalian Coal Syndicate, controlling an annual output of over 100,000,000 tons of coal, is so financially and commercially strong, that despite the fact that indications existed last March that a reaction was commencing in the iron and steel and other industries, the syndicate brought into operation on April 1st an increase in the prices of coal, coke and briquettes. This lack of consideration for the requirements of consumers was also participated in by the Essen Pig-Iron Syndicate, which holds absolute sway over the whole of the marketable tonnage of pig-iron in Germany. Not only were the prices of pig-iron of all qualities maintained on a high level throughout the year, but in some cases still higher charges were made to the foundries for any tonnage in excess of contracts in force, and also, we believe, to the comparatively few steel works which still have no blast furnaces for producing their own supplies of raw material.

On the other hand, it is of interest to contrast this attitude with that of the Steel Syndicate which now only regulates an annual possible production of 6,500,000 tons of semi-finished steel, railway material, and shapes, whereas, a year or two ago, the output controlled was 12,500,000 tons, the difference being explained by the circumstance that the constituents in 1912 refused to be any longer restricted in their development in steel bars, wire rods, plates and sheets, tubes, and castings and forgings. The Steel Syndicate—alone of the three great combinations for raw materials—gradually took into account the changes proceeding in the industrial situation as particularly affecting consumers of semi-finished steel, owing to the fall in the prices of manu-

factures. This was first manifested by an increase from 10s. to 15s. per ton in June in the amount of the export bounty granted to consumers of partly-manufactured steel who make finished products for the export market. In the second place, and in order to stimulate the declining demand, the syndicate reduced the prices of semi-finished steel by 5s. per ton in the third quarter, and also by 5s. per ton in the final quarter, so that, including the export bounty, the inland prices for the production of export commodities were really brought down to the values of the lower export prices f.o.b. Antwerp for the same class of material.

It will be understood that under the influence of higher prices in 1913, and of an exceptionally large demand in the first half of the year, the volume of business and the financial results for the whole year were very satisfactory for the colliery owners. Taken as a whole, the iron and steel trades also had a fairly favourable 12 months, but the principal sufferers from the heavy fall in the prices of manufactures and the slackening of new business, particularly in the second six months, were the owners of the finishing mills in Westphalia and the Siegerland, who are absolutely dependent upon trade rivals for deliveries of raw materials. On the other hand, the large works, producing from raw materials to the most highly-finished products—and most of the trade has either been, or is still, in process of being concentrated in the hands of financially strong companies—felt to a much lesser extent the effects of the diminution in prices, as their costs of production are considerably lower than those of their less-favoured competitors, and they were, and still are, able to search for and obtain orders which the mere finishing mills are unable even to take into consideration as commercial transactions. The production of pig-iron amounted to 19,291,000 tons in 1913, or 1,395,000 tons in excess of the previous year, but a number of furnaces were blown out or slowed down in the final quarter in consequence of the reduced demand. Many furnaces have to be kept in blast in order that the furnace gases may be utilised for power or heating purposes in connection with the steel works, and this partly affords an explanation for some of the additional tonnage of pig made last year. On its part, the Steel Syndicate had a turnover of 6,331,000 tons in 1913, or only 110,000 tons less than in the preceding year.

The promotion of the export trade, to which special attention is devoted in periods of receding prosperity, was continued and forced last year, and the trade returns for the 11 months ended with November show total exports of 5,918,000 tons, as compared with 5,454,000 tons in the equivalent term in 1912, being an advance of 464,000 tons. Owing, however, to the difference in classification, it is necessary to make a deduction of at least 150,000 from each of the two totals, but this necessity does not alter the fact that the export trade showed a large expansion, whilst as a whole the iron and steel trades, apart from prices, had a fairly prosperous year.

The volume of activity enjoyed by the shipbuilding trades was also satisfactory last year. Owing, however, to excessive competition among domestic builders the prices of new construction, both for the merchant marine and the navy, were unfavourable in 1912, as well as in 1913, and the financial results of various shipyards in 1912-13 were unfavourable, the lack of experience in the building of specially large steamers being a contributory factor. No scarcity of orders was experienced, and the merchant vessels under construction on October 1st represented 535,000 gross tons, as contrasted with 467,000 tons a year previously, whilst the orders on hand or in prospect will provide work for the yards for the next two years. The machine construction trade, which was well and profitably employed at the opening of last year, gradually followed the course of the iron and steel trades. As the old orders were completed, new contracts became fewer, and came to hand more slowly.

The chemical and the electrical industries were the only two trades which experienced no material effects from the general retrogressive movement in the economic situation. In taking the electrical industry into consideration, it has to be remembered that the manufacturing departments are preponderatingly concentrated in the hands of three or four large companies, one alone of which is believed to provide occupation for as many workers as are engaged in the whole of the other branches combined, outside of the three or four firms in question. Yet these outside firms—the special electrotechnical works, as they are termed by their representative association—are responsible for approximately 70,000 workers throughout the country, and are therefore of considerable importance in many branches of the industry. As to the course of business in general in 1913, it cannot be denied that it was very satisfactory. It is true that a slight slackening occurred in the heavy branches—at least the Siemens-Schuckert Co. reported a weakening for a portion of the financial year 1912-13—but the telegraphic and telephonic apparatus branches were rather severely hit by the decreased volume of business. Apart from these circumstances, the manufacturing industries were well and profitably employed during the year, although sale prices, as the chairman of the Schuckert Electricity Co. declared on January 8th, have not yet reached the level which would afford adequate profits in proportion to the turnover.

The A.E.G., which had a considerably increased business in 1912-13, completed in the three months ended with October, 1913, orders of the value of £1,150,000 in excess of the corresponding period in 1912, and two months later the company announced that the orders then on hand were greater by the value of £1,500,000 than on the same date in 1912. But more recent information was given by Dr. Spiecker, chairman of the Siemens & Halske Co., when addressing the shareholders on January 6th, 1914. The chairman, in referring to the Siemens-Schuckert Works, in which the Siemens & Halske Co. is one of the two proprietors, recalled the statement made in the former's annual report to the effect that a slackening had occurred, but that a change for the better had recently taken place. This improvement, the chairman of the Siemens & Halske Co. was able to announce, has continued down to the present time, and unless unforeseen circumstances arise, it will be possible to reckon also on satisfactory results for the current and ensuring years. As to the separate undertaking of the Siemens & Halske Co. itself, Dr. Spiecker admitted that notwithstanding an increased turnover in 1912-13, the net profits had not materially advanced, but this was due to the pressure of competition. The degree of activity, which next occupied attention, was illustrated by the statement that since the conclusion of the financial year the number of workers employed was greater than at the close of the financial year 1912-13, and the orders had undergone a corresponding increase. The questions of improving the methods of manufacturing, and of further substituting labour-saving machinery for manual labour, are constantly engaging the attention of the three companies mentioned, and in this connection the A.E.G. was able to intimate for 1912-13 that notwithstanding the greatly augmented volume of business, the actual number of workers had been reduced. These factors appear to command consideration in every trade in Germany where the financial situation of the works concerned will permit of expenditure being incurred for these purposes, and they have a certain bearing upon the successful cultivation of the export trade, which is being specially developed by the huge electrical firms.

The future seems to be regarded by the large electrical interests with confidence, and the lesser important firms

have, therefore, no reason for apprehensions on their part, in view of the contest which they are successful in conducting with the great works. The extension of electricity supply or overland generating stations is proceeding, new tramways are being built and existing lines prolonged; the conversion of the Berlin City and Circle Railways has yet to be put in hand, and the underground line from Gesundbrunnen to Neukolln and the North-South Berlin lines have also to be constructed; whilst other railway schemes are projected or in progress in the country. The year 1913 concluded favourably, and, with cheaper money now available, the prospects for the present year are deemed to be very hopeful for the home market, and foreign markets may be expected to receive further attention in the near future, particularly if, contrary to expectation, the electrical industry should be drawn within the cycle of declining trade prosperity.

The Senghenydd Verdict.

THE inquest upon the 439 victims of the Senghenydd explosion ended on Wednesday, the 14th inst., after a prolonged hearing lasting over eight days. The Home Office inquiry, on the other hand, had to be adjourned indefinitely, as it was found impossible to carry out the two inquiries simultaneously. We mentioned last week how difficult and awkward it would be if the two inquiries went on together; in fact there seems to have been quite a little clash of arms between the Coroner and the Home Office on the question of precedence, in which the former got the best of it.

As regards the verdict of the jury, they found as follows:—That death was due to accidental causes; that the colliery was properly ventilated and properly inspected on the morning of the explosion; that there were a sufficient number of examiners; that the explosion was due to gas, and was fed by coal dust; that there was a systematic cleaning of the floors of the roads, but, they thought, more attention should be given to the roof and sides. They suggested the placing of sprinklers much nearer to the working places than at present, and urged the Home Office to endeavour to find means of dealing with the dust problem. There was insufficient evidence to state clearly the place where the explosion originated, but there was a preponderance of evidence to enable them to fix the lamp station as the probable starting point. They were unable to say whether the gas was ignited by a spark from the electric wire, but the evidence pointed to the naked light at the lamp station as the cause of ignition; there was no neglect on the part of any persons contributing to the deaths of the victims. They also made the following recommendations:—That the lamp station should be placed in the archway near the shaft; that the water tanks should be fitted with a sprayer instead of the men having to use shovels and buckets; and expressed the opinion that there was an insufficient number of inspectors of mines to enable a thorough inspection of the colliery to be made as often as it should be done.

With the verdict most people who have followed the evidence will, we think, with ourselves, be in complete agreement, and as regards the origin of the explosion, namely, at the lamp station, and the cause of the ignition, a naked light, the verdict confirms our agreement with Mr. Shaw's evidence in our issue of last week. As regards the recommendations, however, we very much question either their usefulness or desirability, on the following grounds:—(1) There ought not to be any lamp station where lamps can be opened below ground; (2) It is very questionable whether water spraying has any effect in lessening the danger of coal dust: and (3) If there had been an inspector permanently attached to the Senghenydd Colliery, the explosion would not have been prevented. There were one or two minor breaches of the Coal Mines Regulation Act, but it was admitted that these had absolutely no influence whatever upon the initiation or effect of the explosion. It is the managers' duty to carry out the rules and regulations of the Act, under penalty, and it is absurd—nay, a calumny—to suggest that they are not doing their utmost to render their pits safe and to prevent accidents—not on account of the Act, but because accidents are costly, and we have no hesitation in saying that no amount of inspection or volumes of rules and regulations will improve matters in this respect.

In conclusion, we may just refer to the suggestion that the explosion might have been caused by sparks from the electric signalling wires. We are glad to note that the jury discounted the suggestion, in accordance with the expression of opinion we put forward last week. Evidence was given that Mr. Sparks carried out a series of experiments at New Tredegar rescue station, which proved that with a pressure of 13½ volts, which was 50 per cent. more than the normal pressure used, it was found impossible to ignite fire-damp. On the other hand, an explosive mixture of town gas and air was ignited instantaneously. As, however, this question will be more minutely dealt with during the Home Office inquiry, we will leave the matter where it is until after the issue of the Commissioner's report.

Electrical Exports and Imports during 1913.

ELSEWHERE in this issue we publish our usual annual summary, in graphic form, of statistics which have appeared month by month in this journal, relating to British electrical export and import business. The curves deal with the most important centres of British trade and with the business of foreign competitors in this country, and indicate with sufficient accuracy the tendency of business during the year just ended and preceding years.

It will be seen that while in the matter of value all previous records of electrical business were exceeded, the curves show unmistakable signs of slackening trade in several directions, accompanied by a revival of activity on the part of the importing interests, whose business in this country has shown no particular expansion during the last few years.

Probably due to the widely-extended character of our overseas trade, the only noticeable effect on our exports as a whole is in the nature of a decreased rate of increase in business, which, it may be—though trade conditions in general do not support the view—is an effect of temporary depression only. We need scarcely add our hope that the latter view may be justified by future events.

The Copper Position.

THE last returns of the American Copper Producers' Association were woefully bad, showing as they did an increase in the stocks at the refineries of about 20,000 tons, owing to the wretchedly small home trade deliveries, but the figures are believed on this side of the Atlantic to be much too bad to be correct, consequently their effect was less than might have been expected. Partly under the influence of these figures, copper fell to about £62 10s. for near deliveries, but from this point there was a steady and sustained recovery. For one thing, the mid-January European statistics infused some heart into the market, for they showed that the position here was not nearly so indifferent as that in the United States, there being actually a decrease of about 1,000 tons in the stocks in England and France, while there was a decided drop in the quantities afloat from Chile and Australia, and the stocks in unspecified European ports had also fallen. This revived the flagging hopes of "bulls," and

there was a little repurchasing done by the "bears," while consumers also came forward with more freedom. For the time being the corner was safely turned, and the market opened this week with a strong tendency on reports that there was some sort of agreement proposed whereby the output of the leading United States producers would be restricted. It is far too soon to say whether the proposals to this effect will mature, but there is a strong opinion in influential quarters that something will be done to adjust matters, and that the leading spirits will prove to be the Amalgamated Copper Co., the American Smelting and Refining Co., and the Phelps Dodge group. These are quite sufficiently powerful interests to sway the course of the market if once they agree to put a restrictive policy into operation, and it may quite well be that something of the kind, though informal, may be brought into being. The attitude of the chief American producers has lately assumed more confidence, and this may indicate that there are good prospects of the limitation of output being put into effective operation, while the prices asked have improved to the measure of the advance in the price of standard copper. The position of copper is really not so bad even apart from the setting up of a restrictive policy, for the European trade continues to absorb large quantities, while it is the opinion of well-informed concerns that in America things are nearing the turning point. There have been so many outside influences which of late have conspired to instil distrust, that all things considered it is a wonder that copper has not suffered more than has proved to be the case. There is a fair amount of electrical work about still, and this leads to hopes that with easier monetary conditions as recently witnessed, there may be a releasing of schemes which dear money would cause to be held in suspense. Some of the German wire firms, especially the larger fry, are hard up for orders, but this is because the Convention regulating the trade is diverting orders for wire to those works which do nothing but drawing, leaving works with mixed plants to concentrate their energies on other material. The immediate prospect at the time of writing is for rather higher prices, seeing that the tone of the market has materially improved on the chances of a restriction of production.

The fact that the labour position at the mines of the Rio Tinto Co., in Spain, has become more threatening again, after it had been thought that things were in a fair way to being settled amicably, constitutes another bull point, and the trend of events in North America has become decidedly more reassuring, for a considerable business has been done by producers at advancing prices. The next American returns are, it is believed, bound to make a better showing than the last, and with easier financial conditions all round, the situation is brighter.

Overhead Mains.

The happy concurrence of Mr. Welbourn's paper on high-pressure overhead transmission lines, and Mr. Trotter's on overhead wire construction for medium and low pressures, has rendered the subject of overhead mains the leading feature of our pages in this issue. The electrical supply industry is fortunate in having placed at its disdisposal the mass of practical information contained in these two papers, each of which is the work of an engineer of very wide experience and authority. Reading with these the excellent paper written by Mr. W. B. Woodhouse in 1910, and that by Mr. Trotter, which was unfortunately entombed in the *Proceedings* of the Institution of Civil Engineers, the constructional engineer will find abundance of inspiration for erecting overhead mains on sound lines, and for devising improved methods. Several articles on actual examples of village lighting with overhead wires have also been published in our pages.

The great importance of the subject is acknowledged by all electrical engineers; contrary to what might be expected, it is increasing in importance, for the bulk of the work that can be accomplished on a commercial basis with underground cables in this country has been done, and practice has become largely standardised. No doubt there is much scope for improvement in underground work, and the adoption of underground cables for pressures exceeding 20,000 volts is already a question of expediency rather than practicability; but progress in this connection is likely to follow well-defined and normal lines. In overhead work, however, owing to the conditions peculiar to this country, which have retarded the development of aerial conductors, not only are we far behind other countries in the extent of our overhead distribution, but also the details of construction must be developed on quite different lines.

Public opinion in Great Britain professes an exaggerated regard for the preservation of human life, and insists upon the most elaborate precautions with this end in view. Hence the inconsistency which, while tolerating the presence of 500-volt copper rods supported usually by solder over our most populous thoroughfares without protest, because experience has shown how little risk is entailed by their use, nevertheless demands the provision of innumerable safeguards around a pair of light, securely-fixed wires carrying a maximum pressure of 250 volts. In the course of time, as experience grows, no doubt the attitude of the public towards electrical mains will grow more reasonable. No such difficulties are met with in our Dominions abroad, where overhead distribution, except in the largest towns, is the rule, and where no trouble is experienced from broken wires. The very safeguards themselves have been known to bring about the disaster they were intended to prevent.

In the meantime, the question is how to meet the requirements with the minimum expense, and in this respect both papers are extremely helpful. It was gratifying, too, to hear the central station engineers who took part in the discussion on his paper, expressing their deep appreciation of the earnest desire that Mr. Trotter had always displayed to co-operate with them to the utmost towards this end—even to the extent of himself inventing the best and simplest device yet employed for preventing the risk of shock from a fallen wire.

The paper by Mr. Welbourn has been discussed at five meetings of the I.E.E. at different centres, and the information obtained will undoubtedly prove of great value to the industry. There is one point to which we wish to draw special attention—the case put forward by the author for the amendment of the law relating to wayleaves. In a thickly-settled country such as this, the obtaining of wayleaves is often the most difficult problem to be solved in erecting an overhead line, and we cordially agree with the many engineers who maintain that one of the most urgent needs of the time is legislation to facilitate this process, to abolish the veto of local authorities, and to compel private owners to grant wayleaves on reasonable terms. The Institution of Electrical Engineers is the one body which can act effectively in this matter, and we trust that the Council will fully appreciate the urgency of the demand for such action.

Wireless Telegraphy on Board Ship.—The International Conference on Safety of Life at Sea, which has been sitting in London, concluded its work on Tuesday. A Convention has been drawn up embodying the conclusions arrived at, and, if ratified during the current year, it will come into force on July 1st, 1915.

The Convention provides for the institution of an ice patrol service in the North Atlantic, under the control of the United States Government, which will keep vessels informed as to the position of ice, by wireless telegraphy.

All merchant vessels, whether steamers or sailing vessels, engaged upon international voyages, and whether they carry passengers or not, if they have on board 50 or more persons, must be provided with wireless telegraph apparatus, and a continuous watch is to be maintained by all such vessels, unless automatic apparatus is devised to render the presence of an attendant unnecessary. The wireless plant must have a range of at least 100 miles, and an emergency apparatus must be provided, unless the main installation is situated in the position of maximum safety. An elaborate classification of vessels is provided for, the foregoing merely representing the general trend of the regulations.

ELECTRICAL CASES IN 1913.

[BY OUR LEGAL CONTRIBUTOR.]

To judge from the number of queries addressed to the editors of the ELECTRICAL REVIEW, it would seem that legal questions are frequently arising in relation to the supply of electricity. Nor are they always easy to solve. The provisions of the various electric lighting acts are seldom considered in the courts; and the majority of serious disputes relating to the supply of electricity and electrical machinery, being of a highly technical nature, are decided by courts of arbitration or by the official referees, whose decisions and rulings are not published to the world. With regard to the most recent electric lighting act—that of 1909—we do not know of any case in which its provisions have been considered by any court.

Nevertheless the digest of cases decided by the courts in the year 1913 does contain certain cases which should be kept in mind. It is proposed to state their effect as concisely as possible.

One case which came before the Court of Appeal (Battersea Borough Council v. County of London Supply Co. (29 T.L.R. 561)) raised the question as to what is meant by the phrase "make a connection." It appears that Sec. 4, Sub-sec. 2, of the London Electric Supply Act, 1908, provides that "an authorised undertaker of a specified company may also by means of electric mains make a connection between any two or more areas which that authorised undertaker or specified company is authorised to supply, or between any such area and a generating station of that authorised undertaker or specified company."

It was held that the words "make a connection" did not mean that there could be only one connection, but that they meant nothing more nor less than "connect."

The Master of the Rolls, in giving judgment, said that he thought that Parliament intended to give the company greater rights and to put them in a position to supply their large district with electricity.

The harnessing of Niagara for the generation of electrical power has given rise to a considerable amount of negotiation and has involved numerous agreements between the Canadian Government and private companies. One such agreement was considered in the case of the Attorney General for Ontario v. Canadian Niagara Power Co. (1912 A.C. 852). It there appeared that by agreement in 1899, supplemental to an agreement in 1892, the respondent company agreed to pay a specified fixed rental for a strip of land lying by the water's edge in a public park, together with the use of a portion of the flow of the river as it passes, which had been placed at their disposal for the purpose of constructing works and generating electricity; and also additional rentals varying in amount by reference to the electrical horse power generated and used and sold or disposed of by the company, "such additional rentals as shall be payable for and from such generation and sale or other disposition" to be paid half-yearly.

It was held that the basis of calculation, according to the true construction of the clause relating to additional rentals, was the highest amount or quantity of electrical horse power generated and used and sold or disposed of at any one time, and so remained until a higher point was reached.

While dealing with Colonial decisions, mention may also be made of the case of Toronto Niagara Power Co. v. North Toronto Corporation (1912) A.C. 834, wherein it was held that the powers given to the appellants by their Act of Incorporation passed in 1902 enable them to enter upon the streets of the town of North Toronto for the purpose of erecting poles to carry power lines for the conveyance of electricity, without first obtaining the leave and licence of the municipality, and are not restricted by the provisions of the Railway Acts of 1888, 1899 and 1906.

Certain principles were laid down in the case of National Telephone Co. v. Postmaster-General 29 T.L.R. 190, which may be of considerable value in future years when the compulsory purchase of tramway undertakings begins to take place.

In the case in question, which in point of length, complexity, and cost, probably beat all previous records of litigation, it will be remembered that the Postmaster-General was under statutory agreement to purchase the undertaking of the National Telephone Co. at a price to be fixed by the Railway and Canal Commissioners. By the agreement by which the Postmaster-General acquired, as from December 31st, 1911, the undertaking of the National Telephone Co., it was, *inter alia*, provided that "the value on December 31st, 1911, of all plant, land, buildings, stores, and furniture purchased by the Postmaster-General . . . shall be the then value (exclusive of any allowance for past or future profits of the undertaking or any compensation for compulsory sale or other consideration whatever) of such plant, building, land, stores, and furniture, having regard to its suitability for the purposes of the Postmaster-General's telephonic service, and in determining the value of any plant no advantage arising from the construction of such plant, by leave of the Postmaster-General, upon any railway or canal over which the Postmaster-General possesses exclusive rights of way for telegraphic lines shall be taken into account."

It was held that the value of the plant taken over by the Postmaster-General was to be arrived at by taking the cost of construction, less depreciation, and that every expense which was necessary to construct the plant was an element to be considered, including in such expense (*inter alia*) the reasonable costs of obtaining subscribers' agreements which were in force at the date of the transfer, and also (Sir James Woodhouse dissenting) the cost of raising capital necessary to construct the plant.

It was also held that the method of depreciation applicable was to take the value as reduced in the ratio which the age bore to the life of the plant, and that the mode of computing the life of the plant was to take its physical life as reduced somewhat in respect of defects and obsolescences of certain classes of the plant.

AMERICAN v. ENGLISH METHODS AS VIEWED BY A COLONIAL.

BY "J. R."

I WAS much interested in Mr. Seabrook's article in the ELECTRICAL REVIEW of November 14th, in which he maintained that American business methods should be copied for England. I should not trouble readers of this journal in this connection after this interval had it not been on the tip of my pen for some time to write you on the same subject, but in a different strain.

Mr. Seabrook's text amounts practically to "The blessed uses of advertisement," holding up the ways of the American as the shining example to us all. Now, I will give place to no man, not even Mr. Seabrook, in unbounded faith in the future in store for our art, but I feel very strongly that pretty pictures are not going to play much part in hastening progress, and that the engineer has still

a lot more to do than the advertiser or the salesman, and I feel a little indignant that Mr. Seabrook should put the services of the drummer above those of the investigator, the scientist, and the engineer. One would think, to hear this young man in a hurry talking, that the electrical art in England had been the most stagnant of all instead of, on the whole, sensationally progressive, Chicago notwithstanding.

Now as an antidote to the recently acquired passion among certain engineers for copying the methods of the soap-maker and the patent medicine vendor, I would like to state a case on the other side, to wit:—

1. That the electricity industry at the present time is largely under public management and should therefore be conducted on model lines. Its methods should be an example in every respect to those carrying on private enterprise, and its advertising matter, for instance, should be scrupulously truthful in spirit and in letter.

2. That the present cost of advertising is such a grievous burden on manufacturers that the selling prices of many of the necessaries of life are unduly high on that account, involving serious economic waste, and one contributing factor to the increasing cost of living.

3. That a truthful presentation of the merits of an article is not the first consideration of most advertisers. That a striking effect is the object usually aimed at—sometimes artistic, often bizarre, and that there is something unfitting in the sight of public undertakers vieing with their competitors in such a field.

4. That from the writer's personal knowledge the statements of some American electrical manufacturers will not bear close investigation.

5. That in the matter of electric stoves, for instance, English makers are already ahead of Americans, and in five years will be unapproachable, whereas in the matter of the presentation by advertisement of the same one would think it was America first, the rest nowhere.

6. That at the same time electric heating and cooking has a long way to go.

7. That those who advertise that electricity has reached the stage where it competes in efficiency, reliability and cheapness with gas for the poor or middle-class householder are guilty of a terminological inexactitude, and are doing at the same time a great deal of harm and no good to what they have at heart.

8. That the best thing that could happen to electric heating and cooking would be the withdrawal for five years of all advertising matter thereon, except in journals circulating among electrical engineers, for the reason—

9. That one satisfied consumer is worth a thousand pictures of her, and one dissatisfied consumer will counterbalance ten thousand, and—

10. That the average electric supply authority is not in earnest in offering electric heating to all its customers unless it can run its distributors red hot, Mr. Chamen being an exception, pointing out to the "Point Fives" that none of them can stand ten stoves installed per street.

I present the above with deference to publicity enthusiasts, and, in conclusion, would respectfully reply to Mr. Seabrook as to whether American (advertising) methods are suitable to English conditions:—

1. That the Englishman can generally be trusted to work out his own salvation.

2. That from my knowledge of the two competitors in this neutral field, the American's advertisement is more "telling" (I do not say what kind of telling), but the Englishman's is the one I would sooner believe.

3. That if advertisement makes the same progress during the next ten years, the public will begin to take some trouble to find out the firms who refrain from it.

4. That you can fool everybody some of the time, that you can fool somebody all the time, but you can't fool everybody all the time.

5. That our gas competitors have been working a good many years and are now entitled to talk some, and that electrical engineers have got to do a lot more working yet before they may talk as much.

6. That finally, in case Mr. Seabrook would gather that I am a stick-in-the-mud, I will say that we are selling current here for ½d. less 10 per cent., and our electric heating business is going on quite nicely, but that we haven't got gas to compete with, thank Heaven.

ELECTRICAL ENGINEERING IN JAPAN.

An interesting article on the development of the electrical engineering industry in Japan appears in a recent issue of the "Japan Weekly Mail," from which we take the following extracts. The latest figures available are those for the year 1911, at which time the capital stock of all companies in Japan interested in electrical enterprises, both in operation and projected, was over £46,200,000. Of the companies actually in operation at the end of 1911, the capital invested was as shown below:—

	Lighting companies.	Electric railway companies.	Electric light and railway companies.	Total.
	£	£	£	£
Total capital ...	13,930,900	1,936,000	15,846,400	31,713,300
Capital paid up ...	9,684,100	1,159,400	13,502,100	24,345,600
Loans on equipment	1,692,800	522,600	1,538,200	3,753,600
Reserve funds ...	624,800	33,800	230,500	889,100

The great development of the electrical engineering industry has taken place since the Russo-Japanese War, for in 1906 the capital invested was only £11,518,000, while in 1903 it was but £2,800,000. Between the last named year and 1911, the output of electric power in Japan advanced from 44,000 to 344,000 kilowatts, and the mileage of the electric cables and wires in use from 5,981 to 33,584; during the same period the mileage of Japanese electric railways advanced from 93 to 704, and the number of electric lamps in use from 457,000, of an average of 10 c.p., to no less than 3,122,000.

The increasing demand for electrical machinery and apparatus of every description has given an impetus to the establishment of works for their manufacture in Japan, in connection with which the Government established a law fixing a standard of quality to be observed in the equipment and the production of electrical engineering work, but despite this law and the fact that many of the factories are well equipped, there are some to which such a remark does not apply, while in a large number of cases the available plant does not permit of operations on a large scale. Hence it is that there is a large importation of electrical machinery and apparatus into Japan, such imports amounting in 1912 to over £500,000.

The principal electrical engineering works in Japan are the following:—

Kobe.—The Mitsubishi Dockyard and Engine Works.

Tokio.—The Shibaura-Seisakujo, the Meidensha, the Keiryoki Seizo Kwaisha, and the Jü Shokai.

Kyoto.—Okumura Denki Kojo.

Osaka.—Osaka Denki, Kaisha-Kawakita, Denki Kigyo Kwaisha.

Ibaraki Prefecture.—Hidate Kojo.

The Shibaura Seisakujo specialises in the manufacture of electric motors in co-operation with the American General Electric Co., and is regarded as

the premier factory in Japan. The Keiryoki Seizo Kwaisha, of Tokio, is specialising in the production of electricity meters.

Notwithstanding the development of the home industry, it is estimated that over 80 per cent. of the electric motors in use in Japan are of foreign make, and despite the efforts of the home manufacturers to drive foreign machinery out of the Japanese market, this is not likely to occur as regards electric plant for many years to come, especially in view of the statement that "all machinery pretending to any degree of accuracy must still be procured abroad."

One feature of the electrical development in Japan is the large number of companies that have sprung into existence to put down plants to utilise water power. At present all the plant for such installations has to be imported, but in view of the fact that a warship has recently been completed at the Mitsubishi Dockyard, at Nagasaki, entirely from Japanese material, the time is approaching when home manufacturers will be able to supply at least a portion of the material for hydro-electric stations.

BRITISH PRACTICE IN THE CONSTRUCTION OF HIGH-TENSION OVERHEAD TRANSMISSION LINES.

BY B. WELBOURN, M.I.E.E.

(*Continued from page* 116.)

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *January*, 1914.)

ON spans up to 50 yds. tramway practice may very safely be followed in using solid wires from 11½ S.W.G. up to 0000 S.W.G. For longer spans and larger sections the conductors should certainly be stranded because of the additional strength obtainable, and 7, 19, or 37-strand conductors will be suitable. When specifying the breaking strain of the copper, it is very useful to employ a formula of the form suggested by Mr. A. P. Trotter :—

$$T = 30 - 20\,D,$$

where T = breaking strain of each wire in tons per sq. in.,
D = diameter of wire in inches.

In other respects the copper should comply with the latest British Engineering Standards Specification, dated March, 1910. The "limit of proportionality" on the wire may be taken at 75 per cent., and the minimum size of solid copper conductor now allowed by the Board of Trade on a high-tension line is No. 11½ S.W.G.

With aluminium it is essential to use stranded conductors, and there should never be less than seven wires in the strand. The breaking strain of the wires employed in the strand can be obtained from a formula similar to the above, viz. :—

$$T = 16{\cdot}5 - 24\,D.$$

In order to obtain suitable wire it is suggested that the specification should call for wire having a "limit of proportionality" of 70 per cent. approximately, and conforming after stranding with the tests set out in the following table :—

SUGGESTED TESTS FOR HARD-DRAWN ALUMINIUM CONDUCTORS.

Standard wire gauge.	Diameter of wire. Inches.	Breaking strain. Tons per sq. in.	Extension on a 5-in. length. Per cent.	Wrapping te
4	0·232	11·00	3·00	Three times round its own diameter on and three times off.
6	0·192	12·00	3·00	
8	0·160	13·00	3·00	
10	0·128	13·50	3·00	
12	0·104	14·00	2·50	
14	0·080	14·50	2·50	
16	0·064	14·75	2·50	

The object of the "wrap test" is to ensure that no brittle wire is used, and it should be noted that compliance with the Board of Trade Regulations is only obtainable by ignoring wires larger than No. 6 S.W.G.

It is usual to make all joints at insulators and not under strain. The best way known to the author for jointing copper on lines which have to carry heavy loads is by means of the copper braids described by Mr. C. Vernier before this Institution.* During calm weather there is no difficulty in making excellent butt-welded joints with blow-lamps on aluminium conductors up to 0·25 sq. in. section.

* ELEC. REV., March 24th, 1911.

Placing one insulator on a ridge-iron above the zinc pole roof and two insulators on a horizontal arm below, is not to be recommended. A better arrangement is that obtained by using three galvanised wrought-iron brackets, two on one side and one on the other side of the pole or all on one side of the pole if there is any possibility of a second circuit being required later. In all real heavy work steel channel and not wood cross-arms are now generally used, and there is a growing practice to abandon the equilateral triangular arrangement of the wires on three-phase duplicate circuits, and to erect the wires of each circuit either vertically or horizontally. The latter is the better arrangement, as trouble has been experienced with the vertical arrangement through snow loading down an upper wire until it fouled a lower wire. When duplicate circuits are needed it is an excellent plan to place one circuit on a single-pole, and the second on another single pole at least one pole length away from it if way-leaves can be arranged.

The spacing on any length of span should not be less than—3 ft. for 20,000 volts; 2 ft. 6 in. for 11,000 volts; 2 ft. for 6,000 volts; 2-ft. for 3,000 volts.

In order to prevent two conductors in a horizontal plane from swinging together, they should, theoretically, be suspended so that their distance apart is more than twice the maximum deflection, but in practice it is safe to assume that the wires will not swing "dead out of phase," and on 80-yard spans to make the spacing equal to the sag of the conductors at 60° F.

Galvanised channel arm of 3½ in. × 2 in. × ¼-in. standard section is one which is found most useful. The channel arms, being

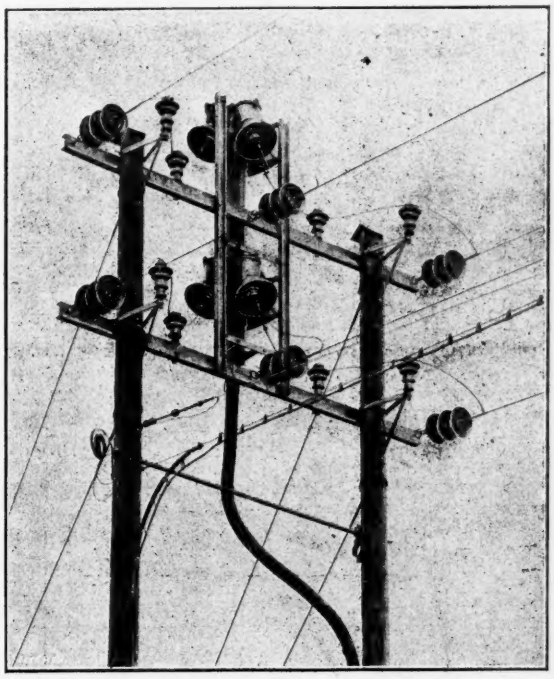


FIG. 2.—TERMINAL POLE.

earthed, have the disadvantage on lines which are operated with an earthed neutral and automatic protective apparatus, that big birds, chiefly crows, stand on the arms and peck at the live wires, involving a shut-down of the line. The difficulty has been overcome on several lines by providing porcelain bushes round the insulator pins from the channel arms upwards into the insulator and by clipping pieces of bitumenised fibre conduit on to the arm so as to insulate the bird.

Tying-in conductors is one of the most important features in the construction of any line.

In the author's opinion the flexible binder demands the services of skilful wiremen, and is the best both for copper and aluminium if it is made correctly. Fig. 4 shows the copper binder which has stood the test of several years' work on the Newcastle-upon-Tyne Electric Supply Co.'s lines, and has never been known to fail. Fig. 5 shows the successful aluminium binder used on the War Office lines at Aldershot and developed on suggestions made by Mr. S. B. Donkin for line conductors up to 0·10 sq. in. For larger conductors the binder shown in fig. 4 is quite suitable. In both these designs one essential feature is the "pigeon" or chafer of wire to prevent abrasion of the line wire and of the glaze on the porcelain. Another feature is that flexibility is obtained without the possibility of longitudinal movement of the conductor.

The only semi-rigid binder known to the author is that designed and patented by Mr. G. K. Paton, chief engineer of the North Wales Power and Traction Co., and used successfully by him both on 72½ miles of single circuit employing solid copper conductors varying from No. 4 to 00 S.W.G., and on 8 miles of single circuit composed of stranded aluminium (fig. 6). The binders have also been used exensively by the Ebbw Vale Steel Co. and the Lambton

and Hetton Colliery Co. The Paton binder was designed to overcome troubles on lines which run over mountains and are subject to very severe weather in winter. Under these conditions it was found that the soft copper flexible binders originally installed stretched and left the line wire loose at the insulator. Vibration in the line wire then caused chafing both of the wire and of the insulator groove, in which the glaze was broken away. The Paton binder is made of solid copper wire, No. 4 to No. 6 S.W.G., according to the size of the line wires of copper. With aluminium lines the aluminium binder varies from No. 2 to No. 6 S.W.G. The

When rigid clamps are very carefully fitted by experienced wiremen, they appear to give satisfaction, but to get good results, each clamp should be fitted to the insulator on which it is to be used, because of the variations in dimensions of all insulators.

Rigid clamps are wrong in principle, because they reflect back vibrations in the line wire, and ultimately the line wires must crystallise and break at these clamps, even if the clamps do not fail first.

In making a telephone-line binder (fig. 7), a cushion of, say, 24 turns is first made on the line wire, and the two ends are then

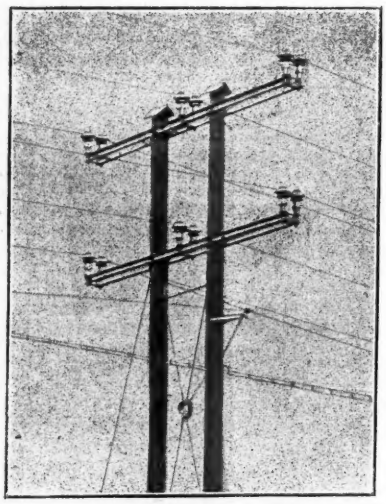


FIG. 3.—CORNER POLE.

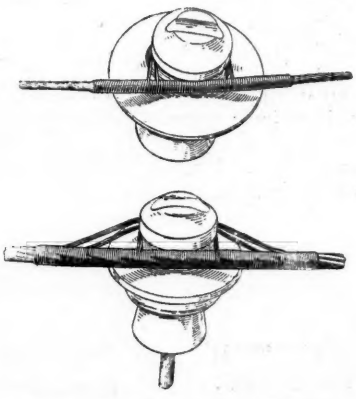


FIG. 4.—FLEXIBLE COPPER BINDER.

FIG. 5.—FLEXIBLE ALUMINIUM BINDER.

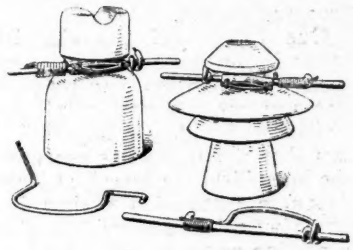


FIG. 6.—PATON SEMI-RIGID BINDER.

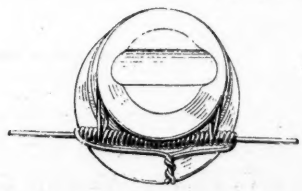
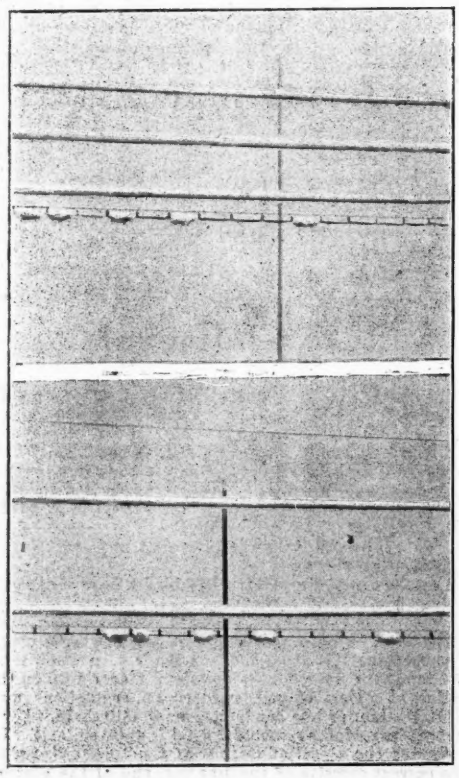


FIG. 7.—FLEXIBLE TELEPHONE BINDER.

binder is formed on a special jig to clip round the neck of the insulator, a standard jig being made for each size of insulator. The binder is hooked on the line wire and then bound under tension at the other end with about 15 turns of No. 14 S.W.G. soft binding wire. A leather or pig-skin chafer is fixed between the

taken around the insulator; in order to avoid having a cross at the back, the wire which starts under the line wire is kept at the bottom of the groove and under the line wire at the other side, and similarly the other wire is kept at the top of the groove and over the line wire. Not less than four turns are now made round



FIGS. 8 AND 9.—SNOW-LADEN WIRES.

line wire and the neck of the insulator, and after five years' use it has been found that the chafer remains as good as new and does absolutely stop the chafing effects on the wire and the insulator. The whole binder remains tight and is yet flexible owing to the cushioning effect of the chafer. The cost is about the same as that of a well-made flexible copper binder, and about one-fourth the cost of some mechanical clips. No special skill is required for fixing it.

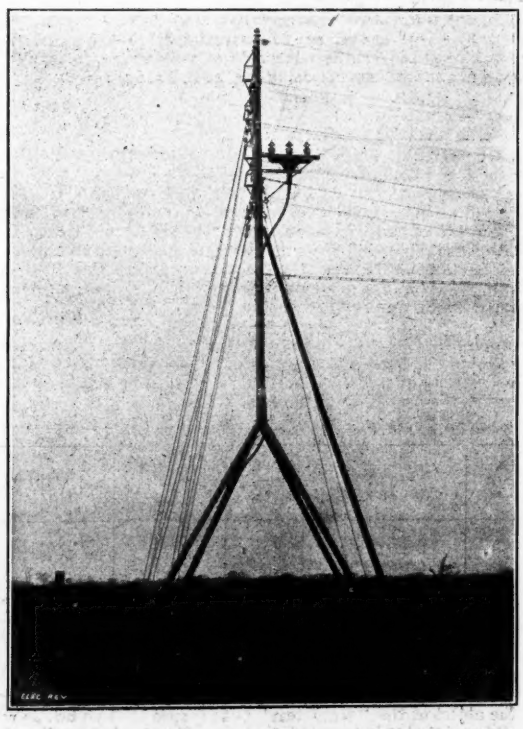


FIG. 10.—CALLENDER-KAY TERMINAL POLE.

the line wire on each side, and the ends are brought together and twisted to prevent the binder spreading.

(*To be concluded.*)

DISCUSSION IN LONDON.

In opening the discussion on this paper, MR. W. B. WOODHOUSE said the question of altering the law relating to overhead transmission lines had often been discussed since Mr. Addenbrooke brought the matter before the Institution in 1905. The question of way-

leaves was important, and he asked whether the author included the cost of these in his figures of cost of lines. The author avoided discussing tension and the effect of elasticity in modifying loading; he (the speaker) disagreed with the suggested specification for aluminium wires, as elongation could not be measured from a 5-in. specimen. "Earths" were very unreliable, and he had known a 10,000-volt wire fall on to the ground and not trip the switches; the best results were obtained with numerous earth plates coupled

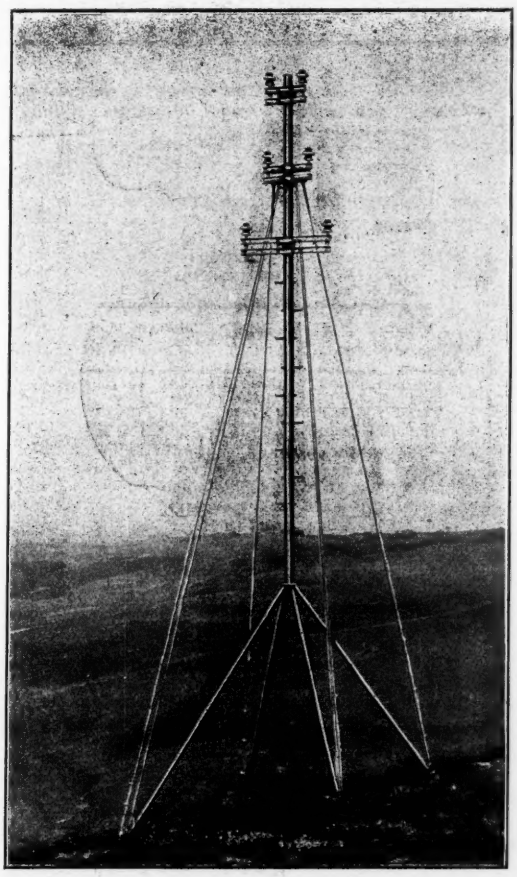


FIG. 11.—CALLENDER-KAY POLE FOR 1,400 FT. TRANSMISSION SPAN.

together. He agreed with the author that lightning arresters were useless. The minimum spacing of wires depended on the clearance necessary at the points of support, allowance had also to be made for the swinging of wires in long spans, but it was not necessary to give such large spacings as were suggested by the author. As regarded outdoor terminals, experience showed that boxes with insulators on the top broke down in time, but the box shown by the author would be awkward to fill and fit in rough weather; the clearance between conductor and earthed metal also seemed small. The insulators should be renewable with little trouble.

MR. A. P. TROTTER pointed out that the B. of T. regulations were based on the best practice of the day, and would be further amended when necessary. It was quite important that insulation should not depend on glaze on an insulator, as the glaze was worn by the binding wire and the porcelain was liable to be ground away. Tests had proved the 18-in. square earth plate to give the best results. As regarded the running of transmissions along main country roads, it was hardly worth while, as the Post Office occupied all the straight roads with telegraphs, &c., and it was better to run straight across fields than follow crooked lanes. Some reference was made to the use of pole transformers, which he was told was a fruitful source of fatal accidents in Japanese cities; he would be very sorry to see little transformers, the size of hat-boxes, on poles supplying farm houses from H.T. pole lines in this country.

COMMANDER SCHWANN drew attention to the effect of overhead transmission lines on aerial navigation, which would develop greatly in future. Lines across open country were very hard to see, and in such positions were very dangerous to aerial craft. It was proposed to make charts showing the routes of such lines, and he urged if possible that the lines should be rendered distinguishable from above.

MR. C. W. KAY described and illustrated by means of slides the new Callender-Kay tubular pole, which we illustrate in figs. 10 and 11. This is of very light and simple construction, facilitating transport and erection, and consists of a vertical tubular pole standing on the point of junction of four inclined legs with square thrust plates on the ends embedded in the ground. The vertical top pole is guyed to each of the inclined legs and one of the thrust plates is galvanised and used as an earth plate. The type of construction was developed experimentally, and poles were tested to destruction; all were designed to fail at four times the working load and withstood the tests with success. The author described a 560 ft. span using 65-ft. poles in the North of England, and a 1,420-ft. span (the largest in England) using 40-ft. poles, the factor of safety on poles and line being about 7. An 81-ft. high pole for a three-phase line near Sheffield was also illustrated. Erection with the materials on the ground was, he said, a matter of 1-1½ hours; and maintenance and upkeep were much smaller than for a lattice pole.

MR. CHARLES VERNIER remarked on the extent of overhead transmission lines operating in this country. The capital cost of overhead lines of high voltage was only about a third that of underground cable. The cost of wayleaves was, if anything, over £100 per mile, and one must not forget that a short cut with underground cable would also necessitate payment for wayleaves, if across private property. Wayleaves were a real difficulty, and it would be useful if the Institution could take the matter up; he

FIG. 12.—TRANSMISSION ACROSS HAYLE HARBOUR, CORNWALL.

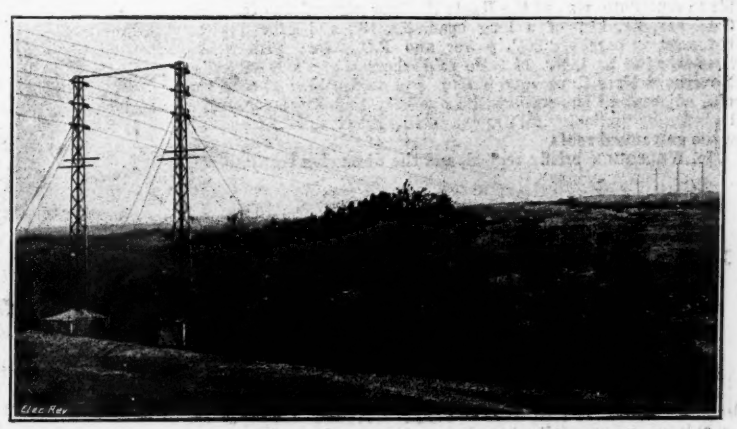


FIG. 13.—A LONG SPAN; CORNWALL POWER CO.'S LINES.

believed the local veto on H.T. lines originated in connection with the H.T. wires running from the Grosvenor Gallery Station in London. He had no wish to see any reduction in factors of safety in connection with his work; he doubted whether prior to the storm of January last people had any idea of real snow conditions

in this country, but out of 42 overhead lines in use on his system, only three were seriously affected. All the heavier wires stood well, and he rather favoured the use of heavy wires in future work.

[In connection with the above matter, Mr. Vernier has kindly allowed us to reproduce two views of snowed-up wires, shown by Mr. Welbourn; the overall diameter of the snow-laden wires shown was 5 in., the size of the copper wire was ·05 sq. in. 9/32-in. diameter. The uncoated wire at the top of fig. 9 is the middle wire of fig. 8, which sprung up some 5 ft. when the snow was knocked off. The spans were 80 yds. The views illustrate the danger of erecting wires in the same vertical plane.]

Mr Vernier, continuing, said he had never yet been able to make a case for steel poles, the maintenance cost being so high,

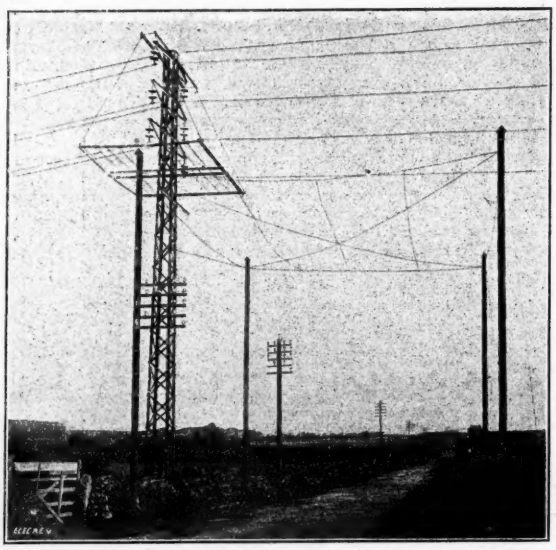


Fig. 14.—Lattice Pole carrying Power and P.O. Wires, Cornwall Power Co.

and he did not believe in the practice of running duplicate lines on the same pole. He agreed as to the trouble experienced with birds, and had given considerable attention to the matter without much success.

Mr. A. Jacob regretted that some comparison had not been made with long-distance transmissions abroad. While there were 650,000 yds. of aluminium lines in use in this country, there were many thousand times this amount in use abroad. He referred at some length to the use of aluminium in Scandinavian transmission work, incidentally mentioning the winter effect on the Rjukan transmission lines, described in our issue of January 2nd, page 22. Various views were shown, one being of a 1,970-ft. aluminium span, and another of comparative curves based on the French, German and American regulations for overhead lines.

Mr. J. S. Highfield said it was important that there should be no movement between wire and insulator for reasons already stated; it was also better to use two small earth plates than one large one, and where several earth plates were used these should be spaced out.

Mr. J. C. Wigham showed a number of views of the overhead transmissions of the Cornwall Power Co., some of which we are able to reproduce, viz., of the Hayle Harbour span of 900 ft., with 40 ft. sag, fig. 12; of a long span, fig. 13; and of a typical pole erection carrying both power and P.O. wires, with guard wires over the road, fig. 14. He said there was about 40 miles of overhead lines in use and no underground cable; at terminal poles adjacent to sub-stations the overhead lines were coupled to the latter by vertical wires dropping straight to insulator terminals in the galvanised roofs.

Mr. Welbourn briefly replied, and the discussion closed.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

B.T.H. Electric Hoists.

The British Thomson-Houston Co., Ltd., of Rugby, are introducing a new form of electric hoist to meet conditions where it would be difficult or inefficient to install travelling cranes of the usual type, and especially for places where small loads are frequently handled.

Fig. 1 shows a Type S_1 hoist with motor-driven trolley, but it is also supplied with a plain trolley, for hand travelling, and is designed for loads up to ½ ton and 1 ton with different types of controller.

The apparatus consists of a cylindrical iron casting containing the motor, controller and hoisting drum; this is bolted through suspension lugs to a four-wheeled trolley running on a rolled steel joist. The gears are located outside the frame, but are covered in. The hoisting drum, of cast-iron, is grooved to receive the full diameter of the $\frac{5}{16}$-in. diameter flexible rope; an automatic limit device acting on the controller prevents overwinding.

Either 50-cycle A.C. or D.C. motors of 1½ H.P. are fitted, for pressures between 110 and 550 volts, with drum type controllers—

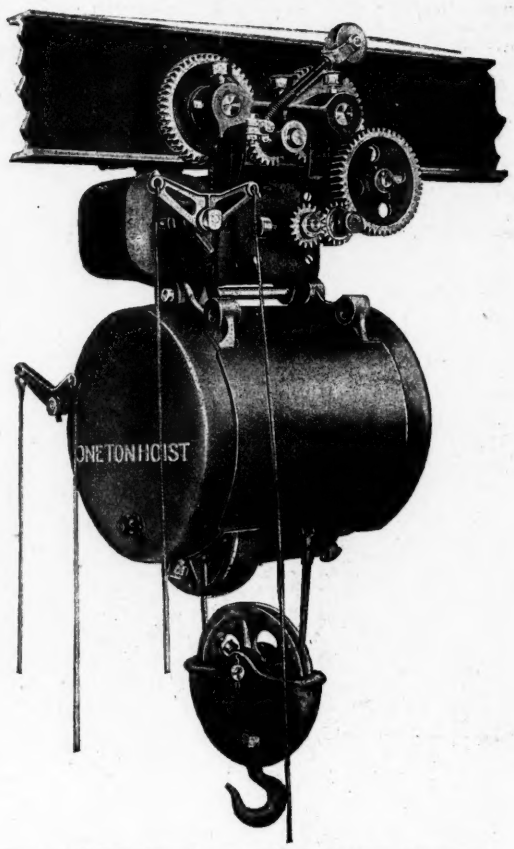


Fig. 1.—B.T.H. Hoist with Motor-Driven Trolley.

the "single speed" type for work not requiring accurate setting of the load, "rheostatic" type where accurate setting is required, and "foundry" type for slow speeds with two-rope hoists.

The armature shaft carries a service brake which is automatically applied by stopping the motor; a load brake of the screw and disk type is also fitted for use when lowering.

The "Morehen" Stage Plug and Socket.

A plug and socket which have been specially designed by a competent stage engineer to meet the stringent conditions of theatrical work have recently been introduced by the General Electric Co, Ltd, of 67, Queen Victoria Street, London, E.C. This,

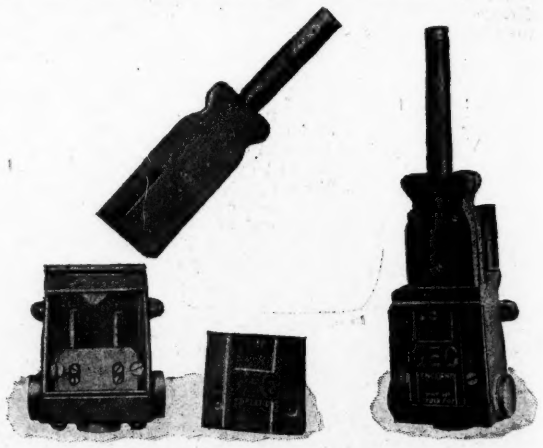


Fig. 2.—View of Interior of Socket with front and Plug removed.
Fig. 3.—G.E.C. Stage Plug and Socket.

known as the "Morehen" plug, is an adaptation of the G.E.C. dock plugs, modified to suit the special requirements of theatres and music halls. The socket is fixed under the stage level, and affords every facility for taking temporary leads to portable stage

properties. The plug portion is of hard wood and is practically unbreakable. Having no projecting pins, the live end may be dropped on a metal floor without danger of shorting, while the counter-sunk contacts preclude all danger of shock. As will be observed from the illustrations, when the plug is removed, the protecting lid automatically closes up the plug entrance, and is designed so that there is little liability for water or dust to enter the interior. Nevertheless, under extreme circumstances, it is impossible even to keep water out, and in order that any water that enters may immediately be discharged, the socket is designed with tapering sides and with an inclined bottom, the water immediately running out of two holes which are provided. The plug is so designed that it is impossible to reverse the polarity, and it can therefore be used on arc-lamp circuits. The plug can be supplied for either arc or incandescent lamps, each type being non-interchangeable, *i.e.*, an incandescent plug cannot be inserted in an arc lamp socket or *vice versâ*. These plugs have already been supplied to a number of theatres and music halls, in which they have met with every success.

Low-Temperature Indicator.

THE FOSTER INSTRUMENT CO., of Letchworth, have made an application of the Hoskins alloys to the measurement of relatively low temperatures such as are met with in electrical machinery. In this apparatus, illustrated in fig. 4, advantage is taken of the relatively high E.M.F. of the Hoskins thermo-couple to give an open scale on a simple and robust portable indicator. In this case the thermo-couple comprises a central wire insulated from an outer tube, the two being joined together at the tip, forming the "hot junction." The thermo-couple is about three-sixteenths of an inch in diameter except at the tip, which is flattened to about

FIG. 4.—HOSKINS ALLOY PYROMETER FOR LOW TEMPERATURES.

$\frac{3}{16}$ in. × $\frac{1}{16}$ in. This flattened tip is therefore convenient for insertion in very narrow spaces, and the whole thermo-couple being semi-flexible, it is easy to apply it to a wide variety of cases. The flexible cable giving connection to the portable indicator is of the "compensating" type, transferring the "cold junction" to the interior of the indicator itself. A mercury thermometer inside the case may be read through the scale opening, and the zero of the instrument correspondingly set before taking a series of readings. By this method cold-junction correction is avoided.

Universal Conduit Box.

MESSRS. SIMPLEX CONDUITS, LTD., of 116, Charing Cross Road, W.C., have sent us particulars of an improved universal conduit box which they have introduced. The box, which is illustrated in fig. 5, is primarily intended for screwed conduit installation, and can be used as a bend, or a T box, for mounting

FIG. 5.—NEW PATTERN UNIVERSAL CONDUIT BOX, WITH CAST-IRON COVER.

such accessories as ceiling roses, switches, wall plugs, &c., thus lending itself to a wide range of applications; it can be had undrilled or tapped for conduit as desired, and is issued at reduced prices (supplementary list T5).

Automatic Temperature Control.

THE STEAM FITTINGS CO., LTD., of West Drayton, Middlesex, have introduced an electric automatic control system in connection with steam or hot water heating systems, radiators, calorifiers, &c., of which the arrangement, as applied to an ordinary L.P. steam radiator, is shown in fig. 6.

The arrangement consists of a contact thermometer and a solenoid operating a valve, and designed to use 100-250 volts direct current. Where only alternating current is available, direct current can be obtained from an electrolytic rectifier, except for the standard ¾-in. valve size, which can be supplied for 110 volts, 50 periods, suitable for L.P. heating. The contact thermometer is placed in any desired position in the room, and is connected through terminal box E to solenoid M; with a rise in temperature the solenoid is energised and the polar extensions F attract disk K, closing a double-beat valve V, and thus shutting off the steam supply; a drop in temperature has the reverse effect.

The company guarantees the device to keep the room temperature constant within 2° F. of its setting. D represents a steam injector tube, while C is the condensed water discharge.

Fig. 7 shows a steam boiler G, for which class of apparatus an internal contact thermometer is provided, screwed in at A, and

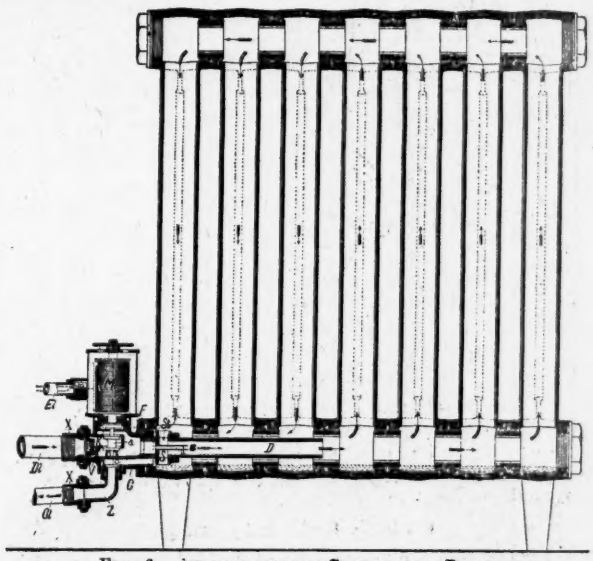


FIG. 6.—AUTOMATICALLY CONTROLLED RADIATOR.

electrically connected to the solenoid-operated valve B, in the supply pipe C.

Temperature regulation can be effected by turning a screw on A; a reference thermometer E can be supplied if desired. Temperature differences of ½° above or below the setting cause the contact-maker to operate the solenoid and valve.

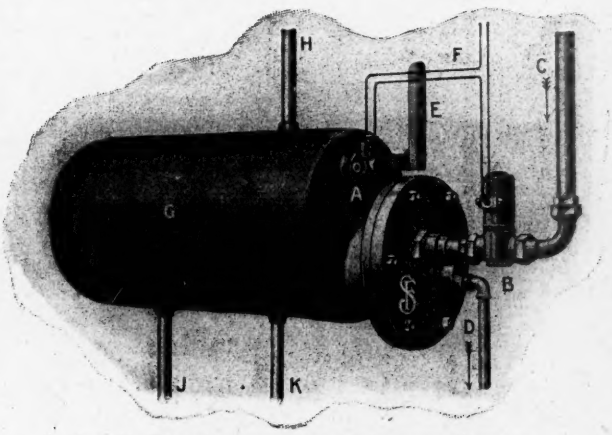


FIG. 7.—BOILER FITTED WITH AUTOMATIC CONTROL.

The power consumption of the solenoid is about 5 watts when energised. The arrangement obviates personal attention and secures the most efficient use of the heating medium.

Variable-Frequency Alternator.

THE CRYPTO ELECTRICAL CO., of 149, Bermondsey Street, S.E., have recently introduced a patented A.C. generator giving practically any frequency over a range of 1 : 4, as from 40 to 160, with a speed variation of only 1 : 2, the generator having a pole-changing device controlled by a single throw-over switch. The machine is of use for testing A.C. motors and meters, &c.

New Half-Watt Lamp Fitting.

MESSRS. NATHAN & ALLEN, of Queen Anne's Chambers, Westminster, who represent the Wardle Engineering Co., send us particulars of a new fitting which will be on the market within the next week or two. It is 3 ft. long, and is intended primarily for street-lighting purposes, for use with any of the half-watt lamps.

The reflectors are designed to give the maximum candle-power at an angle of 20° from the horizontal. The lamp filament is above the level of the bottom of the upper reflector, and the

horizontal rays are reflected at the desired angle, the upper and lower rays being reflected at a similar angle from the conical opal reflector underneath the lamp.

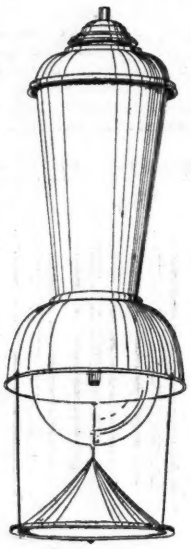


FIG. 8.—STREET FITTING FOR HALF-WATT LAMP.

The lamp is adjustable for focusing, and the fitting can be supplied with an automatic cut-out and substitutional resistance for series working.

Credenda Cooking Apparatus.

Particulars of the new patterns of electric heating and cooking apparatus of the CREDENDA CONDUITS CO., LTD., Chester Street, Aston, Birmingham, have just been issued, and in figs. 9 and 10 we illustrate their grill and cooker. The special feature of the grill is

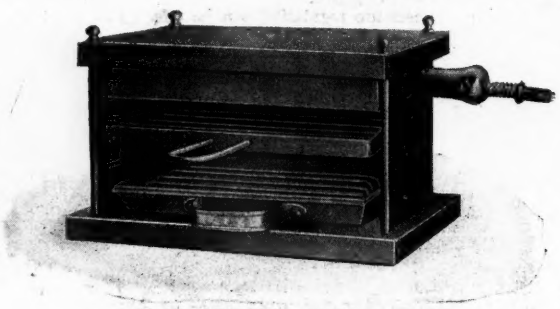


FIG. 9.—CREDENDA ELECTRIC GRILL.

that the heating elements are of the Credenda new bar type, mechanically supported by a channel section of metal insulated with mica, over which the nichrome heating ribbon is wound.

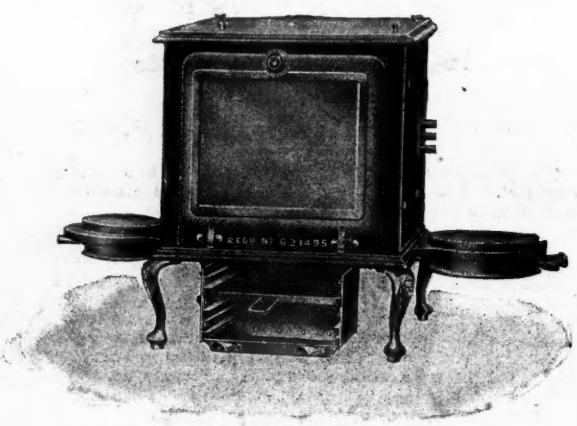


FIG. 10.—CREDENDA ELECTRIC COOKER.

The elements are accessible on removing the top plate, and the lining can be removed for the purpose of cleaning it.

The electric cooker (S 200) is noteworthy in that the whole of the framework can be taken to pieces, and spare parts are standardised; the elements are arranged on heat-plates at either side of the oven, long lengths of heating wire of heavy gauge being wound on six strips, and the whole unit heater can be taken out complete, the strip elements being permanently connected to pin connectors mounted on the heat-plates. With this arrangement, internal wiring is dispensed with, thus avoiding leaks and short-circuits. Outside the oven there are two hot-plates, which can be provided with connector control or switch control, with four heats, as desired. The whole is arranged to stand on a cooking board or table. The cookers are also being manufactured complete with tall cast-iron stands, bringing the hot-plate and oven to a convenient height for cooking, so that one need not stoop. A grill is provided under the oven, and the whole can be controlled by switches. The finish of the plates is art green enamel or polished nickel.

Folding Box for Lamps.

THE BRITANNIA FOLDING BOX CO., LTD., of Dace Road, Old Ford, E, have sent us a sample of their ingenious cardboard box for packing incandescent lamps; the lamp is held in position at both ends without touching the sides of the box, and can be inspected and tested without taking it out of the box. When empty the box folds as flat as an envelope.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Continuity of Supply.

I think shift men in general will be more than ordinarily interested in your leading article in last week's REVIEW on the "Continuity of Supply." It should bring home to chief engineers the fact that even down-trodden shift men may contemplate striking as a means of righting their wrongs. The general run of shift men would, I am sure, be some of the last persons in the world to adopt such a course without a just and sufficient cause, but I ask the question: What is the remedy against such concerns as the Newcastle Electric Supply Co. (sub-stations), Yorkshire Electric Power Co., Bury, Tynemouth and Wakefield Corporations, to mention a few, who have for years past paid their shift men so poorly? We all admit that where a concern is not paying its way the chief is somewhat handicapped and cannot always pay the salaries he would like to, but what excuse have the chiefs of the concerns I have mentioned, which all make decent profits, for paying their men about 10s. per week less than is paid in similar stations for the same class of work?

Shift Engineer.

January 14th, 1914.

Small Electric Light and Power Undertakings.

Referring to Mr. Sowter's letter in your issue of January 2nd, the cost of running these works, which entirely depend upon suction gas plant, and where the total annual sale for the year ending 1912 did not exceed 181,417 units, with a maximum load of 190 KW. on a load factor of only 10·87 per cent., was as follows:—Fuel, ·37d.; oil, waste, water, &c., ·04d.; wages and salaries, ·32d.; repairs, buildings, plant, tools and accumulators, ·27d.; total works costs, 1·00d.

It is interesting to note that this figure is much lower than those of many of the undertakings using Diesel or gas engines, though their outputs are considerably better.

There is one point in which this station possesses an advantage over a great many other gas-driven stations, and that is that the gas plants are fitted with exhausters. The additional cost is, in my opinion, justified in sizes over 150 H.P., not only on account of the fact that you relieve the attendant of a large amount of manual labour, but because the gas can be obtained with certainty and celerity. This is a special point, because in connection with gas-driven stations it is often said that the serious risk of an occasional failure to get gas unfits them for electric supply. With a hand-starting fan you are liable, when conditions are bad, to be troubled with an occasional delay, and the possibility of this necessitates the attempt being made in

good time every day, whereas, if fitted with exhausters, gas can be relied upon in full quantity in a quarter of an hour. It is not that the time taken is anything remarkable, although it is pretty good with a large size gas plant, but the regularity is of great importance.

It is a serious matter for those stations which are wholly dependent upon one source for a supply of fuel, and it is not surprising to note the rapid developments that suction gas is making for small undertakings.

As time goes on it is quite reasonable to conclude that gas will be produced satisfactorily from even less expensive fuel, when existing engines will only require the improved plant to bring them up to date in the matter of fuel cost.

With regard to the method of starting small gas engines referred to in Mr. Girling's article, this system has been in use here several years, and is very satisfactory.

The capital cost of a 150-KW. suction gas engine plant complete with cooling tower, compressed air starter and reservoirs, piping, &c., erected on purchaser's foundations is approximately £13·7 per KW.

It is somewhat regrettable that only a small proportion of the gas-driven stations publish their records, as such data would be of great assistance to engineers responsible for the small undertakings.

F. Swarbrick, A.M.I.E.E., A.M.I.Mech.E.,
Engineer and Manager.

Electricity Works, Minehead.
January 13th, 1914.

Co-operative Control of Electric Supply Undertakings.

It seems to be admitted on all hands that the existing position of electric supply in this country is most unsatisfactory, and it is apparent that the reorganisation of this important industry on the best lines in the public interest is a problem requiring the most careful consideration. No doubt this is the reason why none of your correspondents who are opposed to municipal or State control have so far ventured to formulate any scheme of reorganisation.

Whether dual company and municipal control, or entire State control, be the ultimate remedy, it can be shown that the new scheme referred to in your leading article on December 19th last, to form a holding company to acquire control of the existing companies in the London area, is a form of control open to serious objections equal to, if not greater than, those pertaining to any municipally-controlled electric undertaking.

Control of electrical undertakings, as at present existing, by a holding company puts such a company in an arbitrary position, rendering the safeguards of the Electric Lighting Acts worse than useless. There is nothing to prevent a holding company forcing on its subordinate company, the Parliamentary undertaking, either plant for the operation of the business or a supply of electricity in bulk at any price it thinks fit, 50 or 100 per cent. above or below market price. The holding company may take a profit direct or bear a loss direct that properly belongs to the subordinate company, the Parliamentary undertaking. Or the holding company may bring in an outside company to co-operate with it in taking exorbitant profits out of the Parliamentary undertaking, to the detriment of a cheap supply to the manufacturing community. Thus the statutory accounts of a Parliamentary undertaking, devised for the protection of the public, may be made to show either a profit or a loss not genuine at will of the holding company. A holding company may therefore be taking unlimited profits out of a Parliamentary undertaking, the benefit of which, or a portion of it, ought to be employed in a reduction of price to the consumer, to enable him to hold his own against foreign competition. The irregularities that may be practised by a holding company are without limit.

Unless some means can be devised whereby existing company control can be properly and adequately safeguarded so that the cheapest possible supply may be assured, many who are not the Socialists feared by Mr. Seabrook will have no alternative but to support a scheme for the nationalisation of electric power supply, as suggested in Mr. R. A. Chattock's able article in your journal of December 19th last, on similar lines to Government control of the postal service.

Mr. Seabrook's objections to municipal or State control set forth in your issue of December 26th last do not help much. If he or some other expert would show how an effective dual or co-operative control could be arrived at so that the cheapest and most reliable supply of power were secured to the national industries to enable them to compete in the markets of the world, a public service would be performed.

That something definite should be done to render impossible the abuses at present practised under the Electric Lighting Acts is imperative. I incline to think that investigation by a Parliamentary Committee into the whole subject of electric power supply is desirable at the present juncture. If in the meantime the projected scheme for a holding company to acquire control of the various power companies in the London area is proceeded with, the Bill will require careful watching in the public interest. Control by a holding company appears to be the worst of all possible types.

Andrew Gemmell.

Ovingham-on-Tyne, *January 12th*, 1914.

The New Half-Watt Lamp.

It is to be presumed that, at the outset, users will find it difficult to decide which particular make of the above lamp to adopt.

Although I have not so far examined the rival claims very closely, I have discovered that the "Osram" lamp has at least one distinguishing feature, for it is claimed to consume "only one-half watt of electrical *energy* per candle-power."

One word has been italicised by me to make the claim clearer.

W. Perren Maycock.

West Norwood, S.E., *January 16th*, 1914.

Kindly warn your readers to be careful in the erection of "Half-watt" lamps. The installation of one was delayed in a certain Northern town through the fact that a careless erector dropped the lamp from a height of 17 ft. [illegible]

The wind caught it before it reached the pavement, and it was carried out of sight. It was later found by a policeman, who took charge of it and locked it up, under the "Foreign Balloon on English Soil" Act, the "Dog" Act, or the "Explosives" Act—I am not sure which.

It was bailed out the next day and erected satisfactorily, having suffered no harm except from under-feeding whilst in the cells.

By the way, talking of the "Explosives" Act, has a householder any right to keep such a dangerous explosive as "gas" without a proper licence?

Watteau.

[We are assured on unimpeachable authority that the above report is a true statement of fact. The rumour that Rugby football will, in future, be played with half-watt lamps, however, has not been confirmed.—EDS. ELEC. REV.]

The Position of Electrical Railway Staffs.

I was very much interested in the letters by "Omen," "Idoneus Homo," and "Interested," which appeared in your issue of the 16th inst.

The miserable wages paid to educated men who at present fill some of the positions in electrical stations, will effectually stop others from spending time and money in fitting themselves for such positions, and will eventually result in the employment of men whose knowledge of the work is on a par with that of the assistants who form the subject of one of the letters appearing in your last issue.

The employment of these unskilled assistants will not seem to the employer to warrant a higher rate of wages; quite the contrary.

In electrical stations, more than in any others, a mere handful of men control plant which, directly or indirectly, affects to a considerable degree the daily life of the majority of the people in our cities; and further, no stations are more easily rendered inoperative for long periods. In view of these facts, the policy of those responsible for the

present rate of remuneration seems, to say the least of it, short-sighted.

Will these underpaid men, who have been driven to form a Union in order to try and keep their wages at a bare subsistence level, stop to think of the result of their actions on the community in general, should a demand from this Union be met by a refusal—or will the thought of the treatment they received when they offered their services as individual units, blind them to everything except a sense of their wrongs? Judging from the recent strikes here, and the still more recent national strikes in two of the Colonies, there seems no doubt as to the answer.

Personally, I am against strikes; the bitterness they engender far outweighs any advantages that may accrue from them, and they appear to me to be leading to a state of things not far short of civil war. But the present state of affairs in the electrical world is intolerable, and although I agree to a certain extent with your correspondent "Interested," when he says that the chief engineer is, in most cases, to blame, I do not think this gentleman could effect a great improvement unless backed up by united action on the part of the men under him. As long as business is conducted on the present lines, so long will there be shareholders having shares in an undertaking about the inner workings of which they are completely ignorant.

These shareholders will be the first to let directors hear of their displeasure should dividends fall, and an engineer who approached such directors with requests for higher wages for his staff would—in the absence of clamour sufficiently loud to reach the ears of shareholders—be advised to wait until a more favourable moment. It would be an exceptional man who would add to his worries by making himself unpopular with his directors. As long as this state of affairs obtains, any improvement in their conditions must be effected by the men themselves.

Yet Another.

With reference to "Interested's" letter in your last issue, I must endorse his statement that the chief engineers are responsible for the "sweated" conditions under which central station men are working. They do not seem to realise that they are lowering the prestige of their own profession, and incidentally their own position, by their "labour-sweating" tactics. Before very long, if this matter is not rectified, we shall have our municipal councillors asking why the chief engineer is paid so very much more than his assistants. They will naturally conclude that he is being overpaid, and will inform him, if he is not satisfied with his present remuneration, that there are plenty more men, equally as capable, who would only be too glad to take the job for less money. This is exactly what the chief tells his assistants at the present time when they apply for an increase.

Chiefs! I implore you to see, before it is too late, the rut into which you are inadvertently drifting. Increase the status of your own profession by giving your assistants a fair salary, and at the same time you will better your own position. You cannot complain, if you refuse to do what it is your duty to do, that your assistants form associations, &c., to get that which is only due to them.

The A.E.S.E., I am glad to see, has taken this matter up whole-heartedly, and if the chiefs will only step out of their own light, it will not be necessary to introduce Bills into Parliament for the prevention of strikes in central stations.

In conclusion, I must ask all station men who have this matter at heart, and who have not previously done so, to communicate with Mr. W. J. Ebben, honorary secretary, A.E.S.E, 7, Vermont Road, London, E., for unity means strength.

Vapour.

In reference to "Omen's" letter and complaint in last week's Review under this heading, I would point out that the London County Council have, and have had for some considerable time past, a proper quarter to which all such complaints can be referred, namely, the Conciliation Board, which has granted many concessions to the Council's employés since its inception. Why, then, do not "Omen" and his colleagues make their complaint to that, the only constitutional authority, instead of starting an ink-slinging campaign through an already over-burdened Press? Has it taken him 11 years to decide whether he would be justified in joining some suitable Society to look after his interests? If so, one might presume that when he is satisfied that he is so justified, it will take him another 11 years to decide which is a suitable Society. Again, he asks: "Can the A.E.S.E. do anything to help us?" Why not join and see; surely the numerous articles on the Association's objects which have appeared in the Review answer that question, or does "Omen" wish someone to start an Association, pay his subscription and obtain benefits for him, who admittedly has done nothing to assist himself for 11 years?

Charge Engineer L.C.C. Tramways.

Every railway sub-station charge engineer has received particulars, &c., of the A.E.S.E., and has a knowledge of its existence; a good many have been personally canvassed, and a fair proportion have become members.

Now, if some of the railway sub-station men join the N.U.R. and some the A.E.S.E, and a few remain outside both organisations, the effect on future conditions will be nil; perhaps less than this, the conditions may even get worse, owing to the fact that the whole of the men might not be able to act at a given moment. What I wish to emphasise is that all these men must join one organisation, otherwise there is little hope for the future.

Should the railway electrical engineers join the N.U.R., as a body they will constitute only a minute proportion of the Union, and when it comes to a ballot, they will be hopelessly outnumbered and will be pushed hither and thither by the votes of men whose only interest will be to bring their men out in case of a strike.

Of course we have heard of a special committee to be organised by the N.U.R. to look after the sub-station men; a case of get them at all costs.

The A.E.S.E., as its name implies, was formed for electrical station engineers, it is governed by station engineers (railway subs. are well represented), all the officials are station engineers, and all are at present *employed* in electrical stations, consequently the executive know more of the conditions prevailing and the best means for remedying grievances that exist.

Should the N.U.R. wish the sub-station men to co-operate with them in any way and they were all members of the A.E.S.E., the sub-station men could please themselves and make their own terms or demands, whereas if they were members of the N.U.R. they would have to abide by the vote of the majority of the members, who are not electrical engineers.

Now I put it to the railway sub-station men, your future welfare depends on whether you join an organisation to safeguard your interests, or not; strikes (which we all abhor) are caused more by the men who remain outside their organisations, than by those who join them. Railway Electrical Engineers—Choose! A.E.S.E. or N.U.R. It is your duty to yourselves and fellow-workers to join an organisation without delay.

With regard to the question asked in "Omen's" letter in last week's issue, the answer is: Yes, the A.E.S.E. can help L.C.C. electrical engineers as well as the railway electrical engineers, by organising the whole of the workers in this section of the industry, and as we have constantly before us striking examples of that very sad fact that the arrangements of society are founded on force, and also that it is largely carried on by means of the knowledge that force can be exerted, surely these facts speak for themselves.

W. J. Ebben,
Hon. Secretary, Association of Electrical Station Engineers.

London, E., *January 20th*, 1914.

Concerning a Review.

I note that your reviewer still thinks the book in question is worth the price asked. Those who buy the book can judge as to his recommendation as I did. As a matter of fact, I had intended to buy several copies of the book for

distribution to some juniors, but a perusal of the part of most interest to them decided me not to.

In the preface, Mr. Collis says the book deals with the subject in elementary terms and invites criticism, as he again does in his letter in your last issue, and I have pleasure in giving him some details of what I complain of, dealing only with that part of it which treats of the plant in which the juniors I have referred to are interested.

I have dealt with one chapter only of the book, in which there are 34 of the 80 pages and 16 diagrams, some of them full page and some nearly so, and so far as I can see, there is only one satisfactorily clear and accurate diagram, viz., No. 9. Some of the points raised are doubtless not serious, but some of them are, *e.g.*, fig. 2, and I think that there are sufficient errors in the part dealt with to call for the reviewer's comment. Even if they were not serious, there are so many of them that it is surely not unfair to say that most of them should have been corrected before the book was put on sale.

If Mr. Collis considers the diagrams in the light of my remarks, I think he will agree that there are errors not only of omission, but of commission, although one kind is not necessarily worse than the other, and that the book will not—as he hoped in his preference—assist much towards a better understanding of the functions of switchgear.

As one who has had some experience in teaching, I should like to express the opinion that elementary books, above all books, should be accurate, both for the sake of the student and for the sake of the apparatus and plant he has to handle.

R. Rankin.

Ilford, *January 13th*, 1914.

[The list of faults pointed out by our correspondent has been forwarded to the author of the book.—EDS. ELEC. REV.]

Insurance Companies and Consulting Engineers.

The series of letters published in your issue of the 16th inst. are very interesting in their attack upon "Tyke," but only "A.M.I.E.E." has appreciated that genuine insurance companies do not come under the category referred to by "Tyke" in his indictment.

Your correspondent "Facts not Fiction" is very interesting when telling us of his qualifications, but he is hopelessly muddled when he describes as "Fairy Tales" the remarks about earthing and burn outs. I can thoroughly endorse all that "Tyke" has written about the supposed inspectors; I possess the business cards of the individuals in question which contains the names of the insurance companies.

In reply to "Inspector," I would point out that "Tyke" has not had "the misfortune to be enlightened upon some scheme," &c., but wrote the indictment with the primary object of awakening the genuine electrical insurance companies to the fact that companies of the type referred to by "Tyke" are a smudge on fair competition and efficiency, and tend not only to lower the status of the electrical engineer, but of the industry as a whole.

I enclose my card and sign myself

El-les.

British Combines.

A correspondent makes a complaint against the action of an association of electrical manufacturers in postponing for a week beyond the time specified the submission of tenders for certain articles. And in the writer's opinion, as the French say, he "has right" in so doing. For some obscure reason, known only to the association concerned, the prospective buyer is given to understand, in an indirect way, that his Council will be favoured with the required tenders so soon as the combined sellers see fit.

While it must be admitted that this is an extreme instance—and one of which a reasonable explanation will, no doubt, be promptly supplied—and not a general occurrence among our "associations," yet one is drawn to inquire into the ways of these "rings" generally, as to their *raison d'être*, their policies and influence upon business, more especially in the electrical world. Therefore the writer proposes to run briefly over a few points relating to this matter, not with any desire to "give away" any one or other of the associations, but rather to ascertain, by balancing the pros and cons, how far "associations" or "rings" tend to benefit or stultify the welfare of the electrical interests of the country. One can often hear and read of, if not directly experiencing the results oneself, the enormous trusts which have grown up in the United States, some of which deal in commodities of vast importance to all, *e.g.*, oil or foodstuffs. Strange to say, the average citizen here never mentions the kindred organisations on our side of the water. Granted that they are not so powerful in the property and capital at their command, or in the extent of their spheres of influence, still they are numerous, and affect many things as remote in character as common table-salt and tungsten lamps. The electrical trade has its share too. Some of them are well known. Others there are of which comparatively few, even in business, are aware. The policy of all, however, is that of "combines" all the world over; *i.e.*, to obviate price-cutting, and to maintain prices at a satisfactory level. In some cases, members of the "ring" are handicapped month by month according to their aggregate sales for the preceding month, in order that each firm has a chance of sharing orders. It is, of course, essential that orders should be distributed, or the Association would not survive for long, and, whatever may be the method, either the one mentioned or some other, the sharing of orders is the rule.

It is important to notice that, generally speaking, the agreed "ring" prices only operate for home orders or contracts. When a colonial or foreign quotation, with certain exceptions, is involved, each member goes in on his own independent basis, without any interference from the "ring." The reason of this is not far to seek. The competition for "foreign" orders is far more acute than for the home business. This statement may be disputed, but the fact remains that such is the *modus operandi*, and the price to a home buyer is usually in consequence higher, for identical material, than to a buyer in, say, Australia. This is one of the direct results brought about by the existence of the "ring" or "combine," and to term it "protection" is only dubbing it with its rightful name.

The "protection" then being established, the question arises as to whom it benefits. The people concerned are the manufacturer and the employé. If the latter benefits, then he receives higher wages in a "combine" trade than he would in the absence of the "combine." There is ample room for doubt, however, that any class of electrical worker is to-day overburdened with his remuneration, while it is certain that in some branches of unskilled, or semi-skilled labour, newly-formed Unions are forcing wages upwards, showing that these workers have previously been underpaid.

The manufacturer, then, reaps the benefit from the higher prices produced by the "combine," and the reason of its existence is "dividends."

In addition to possessing this protection for the standard Association goods, certain other articles are manufactured, where conditions allow of this being done, in a lower quality. These go partly to supply the cheaper class of job at home, and more extensively the requirements of foreign markets, where the demand for such quality (or price) is considerable.

Probably the same machinery makes both grades of material, and so if the margin is less on the lower grade, this at least may serve at times to keep machinery and workers going, where they would be idle. The making and selling of lower grade goods, useful as they may be as a side line, is, on the other hand, partly a concession to the fact that there are competitors outside the combine. Some of these latter make only one quality of goods, and signs are not lacking that such firms convince the market of the value of this single quality.

Surely if protection of trade, whether for manufacturer or workman, is desirable or necessary to us as a nation, or to the electrical industries specially, it ought to be put upon a proper basis, controlled and subjected to due and lawful restrictions, and labelled "protection" for all to recognise it. In present circumstances, all politics aside, we are nominally a Free Trade country, suffering under the anomaly of more or less open protection in certain industries. It would be more logical to make trusts illegal, and to institute State protection by tariff than to leave things as they

are to-day, and grumble at combines. The effects of the combines in electrical goods are identical with those in other goods.

If prices are held up the users suffer, while the demand may be to some extent restricted also. Therefore the whole electrical industry which employs motors, lamps, cables, &c., in its work, is handicapped. Then the natural rivals of electricity in the world's work receive a gratuitous benefit, which, although applied indirectly, is as certain in its operation as a direct bounty could well be. To point out that others allow combines is no argument in favour of them. There may be sound arguments advanced by the members of this or that association, but essentially, so far as electricity is concerned, there is only one issue. That is, that the influence of combines upon the future of electricity is a retarding one rather than a sustaining and helpful one. The writer has no animosity in this matter whatever, but public questions should stand broad daylight, and this is one of them.

Contracts.

January 12th, 1914.

Poor Law Assessments.

This Council's electricity undertaking has recently been re-assessed, and to get an idea as to whether the new figure is a fair one or not, I circularised some 20 similar undertakings, and from the replies of 10 who were good enough to respond, there is a very, very wide difference in the figures.

As this is a question of interest to many central stations, I should be glad if you could tell me whether the assessment is made upon capital expenditure, gross profit, net profit, or just the Union's fancy. The rating law seems so mixed as to require a "legal" mind to understand it, and, even then, it is doubtful if a clear interpretation could be given.

If any of your readers in England and Wales who have charge of undertakings (either company or municipal), with a capital expenditure up to £30,000, care to send me their capital expenditure on buildings, plant, mains, the gross rateable value and the net rateable value, I shall be pleased to tabulate the replies, and let them have a copy for private use.

C. J. Wood,
Resident Engineer.

Sale U.D.C. Electricity Works,
January 19th, 1914.

The Present Discontent.

Several writers in last week's REVIEW had something to say regarding the conditions and wages in power and sub-station work. While agreeing on several points, I should like to ask whether those writers have considered the other side of the question, and asked themselves whether the general body of men cause their chiefs to look upon them with any interest.

The present writer has met men who on shift have filled in their time practising the banjo, bagpipes and fiddle, in poetry writing and literary work, in repairing bits of motor-cycles with their employers' materials, and in general scrap-iron and marine-store work.

I say that the presence of this sort of man amongst station engineers is detrimental to the interests of those men who are interested in their vocation, and wish to succeed at it; and I should like to state that I firmly believe all men of the uninterested variety, as denoted above, will be enthusiastic supporters of an association which hopes to bring them better pay and shorter hours.

That there are many points which need remedying in power station work is quite true, and it is to be sincerely hoped our chiefs will try to give us better conditions generally. Unfortunately, ours is so comparatively new an occupation that there are no precedents to go by.

One writer misses the point when he makes mention of the 20s.-25s. paid by power companies. I may state here that a man agreeing to stay at least a year at 20s. or 25s., as the case may be, has his wages raised if he gets promotion, and within my knowledge men have succeeded in getting up to 35s. and 37s. 6d. well within their 12 months.

Any man with a little business acumen would request to be shown a copy of any agreement he would have to sign, before throwing up one job to take up another, and if he has not the sense to do so—well, it will be one of those practical little lessons in life which will be of great value to him afterwards. All this of course provided he is at all dissatisfied with the terms of his agreement, which need not necessarily be the case.

But so long as the influx of youths into the occupation is so great, so long as young men with money from home are content to accept low wages, so long as we have "fed-up-with-sea" marine engineers and naval "tiffys," content to work for a time for 25s. to 30s., so long will the pay, prospects, and general conditions of the shift men and sub-men in this industry be poor.

That we are on the mend, however, is the sincere thought of

An Ayrshire Man.

"Rodolite" Heating Elements.

With reference to the letter from your correspondents the Standard Electrical Heating Co., it would have been more to the point had they sent us the sample heating element for inspection, as we should then have been able to indicate wherein it differs from the Bastian "Rodolite" glower.

Anyone interested can turn to the reference in the *Journal* of the Iron and Steel Institute for June, 1908, and judge for himself whether the appliance therein vaguely described in any way resembles our product, and for ourselves, we do not intend to impose upon the hospitality of your columns for the purpose of arguing this particular point.

Probably your correspondents do not appreciate that there is a difference between silica and fused silica or quartz glass, and for further education we would refer them to Paterson and Co., who years ago, in letters addressed to you (also from Newcastle-on-Tyne), professed considerable knowledge of the subject.

C. Orme Bastian.

London, W., *January 19th*, 1914.

[This correspondence must now cease.—EDS. ELEC. REV.]

BUSINESS NOTES.

Bankruptcy Proceedings.—J. G. M. HILTON, electrical engineer, 103, Exchange Buildings, Birmingham.—An application was made at the Court House, Corporation Street, Birmingham, last week, for the discharge from bankruptcy of the above-named debtor. It was stated that the liabilities amounted to £975, but the proofs lodged only totalled £422. No assets had been disclosed. Prior to 1899 the debtor had been managing director of an electrical engineering company, in which he invested £4,000. That company went into voluntary liquidation, and being liable for calls upon shares held by him, the debtor filed his petition in the High Court, with liabilities of over £2,000, and no assets. In 1902 he obtained his discharge, subject to a suspension for two years. After holding several appointments, he commenced an agency in 1905, and his remuneration proving insufficient to meet his creditors, he incurred further liabilities. In 1910 the firm by whom he had been employed discontinued to pay him commission, paying him a salary of £275 per annum, which sum he was still in receipt of. In addition, there was an income of £180 derived from property which the debtor settled on his wife on their marriage, and until recently he had received it, so that he had an income of £450 a year. Mr. Harold Kimpton represented the debtor, and said that the liabilities were incurred through the debtor having had recourse to moneylenders. His client, he said, was willing to submit to a payment of £150, £100 to be paid forthwith, and the balance at £4 a month. The discharge was thereupon granted upon those terms. Last day for receiving proofs for dividend, February 4th. Trustee, Mr. A. S. Cully, 191, Corporation Street, Birmingham.

Arc Welding Sets.—The Parsons Motor Co., Ltd., of Southampton, is supplying two of its paraffin-engined arc welding sets for the North-East Coast and one for the North-West Coast. Several repeat orders have been received lately both for self-contained welding sets and for sets to be fitted on lorries or on barges, &c.

Book Notices.—"*Journal* of the American Society of Mechanical Engineers." Vol. XXXVI, No. 1. January, 1914. New York: The Society. Price 35 cents.

"*Journal* of the Institution of Electrical Engineers." Vol. LII, No. 226. London: E. & F. N. Spon, Ltd. Price 3s. 6d.—The issue for January, 15th. contains the paper on "British Practice in the Construction of High-Tension Overhead Transmisson Lines," by B. Welbourn.

"The Inventor's Advertiser and Manufacturer's Handbook to Patents, Designs and Trade Marks." By Reginald Haddan. Ninth Edition. 1913. London: Harrison & Sons. Price 5s. net.

"Slide Rule Notes." By Col. H. C. Dunlop and C. S. Jackson. 1913. London: Longmans, Green & Co. Price 2s. 6d. net.

"Debentures." By H. W. Jordan. London: Jordan & Sons, Ltd. Price 6d. net.

"Practical Electrician's Pocket Book for 1914." London: S. Rentell & Co. Price 1s. net.

"Efficiency in Technical Education a Factor in the Development of Professional Ideas." By Dr. W. F. M. Goss. (Presidential Address to the American Society of Mechanical Engineers.) New York: The Author.

"*Journal* of the Western Society of Engineers." Vol. XVIII, No. 2. November, 1913. Chicago: The Society. Price 50 cents.

"School of Mines Quarterly." Vol. XXXV, No. 1. November, 1913. New York: Columbia University. Price 50 cents.

"The Physical Review." Vol. II, No. 6. December, 1913. Lancaster, Pa.: The American Physical Society.

"L'Année Electrique." By Dr. F. de Courmelles. 1914. Paris: Ch. Beranger. Price 3 fr. 50.

Trade Announcements.—THE MANSFIELD ENGINEERING CO., of Pelham Street, Mansfield, have registered their business as a limited company under the title "The Mansfield Engineering Co., Ltd.," to take effect as from June 30th last. The conversion has been made purely for family reasons, and it will not affect the management of the business, which will be carried on as heretofore.

MESSRS. W. T. GLOVER & CO., LTD., Trafford Park, Manchester, announce that their Newcastle address henceforward will be :—20, Westgate Road; telegraphic address, "Cables, Newcastle-on-Tyne"; telephone No. "878 City." Stocks of rubber-insulated wires, cables and flexibles are kept at this address.

MR. J. JACKSON, electrical engineer and contractor, announces that he has severed his connection with the late firm of Jackman and Marchant, of Folkestone, and is conducting business on his own account at 12, Connaught Road.

It is announced that the business of the late MR. JAS. GRAY, electrical and general engineer, Hatfield, Herts., will be continued under the style of James Gray & Sons, by his two sons, Messrs. Jas. Wm. and Walter Cecil Gray, who for some time were associated with their father in the business.

The new telephone No. of THE LEITNER ELECTRICAL CO., LTD., is "6477 Victoria."

THE BROMPTON AND KENSINGTON ACCESSORIES CO., LTD., announce that their telephone No. is now "Western 1531" (three lines).

The telephone No. of W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Blomfield Street, E.C., is now "4560 London Wall" (seven lines).

In our last week's notice respecting MR. J. PENDREICH, for Daley Road read Dalry Road.

Catalogues and Lists.—MESSRS. CREDENDA CONDUITS, LTD., Chester Street, Aston, Birmingham.—Fifty-two-page illustrated catalogue of Credenda electric heating and cooking apparatus. Opening notes on cooking by electricity are followed by an illustrated description of the firm's patent disk element. The later pages contain tabulated data and prices as well as excellent pictures of kettles in many shapes, porringers, warming and cooking plates, grills, various utensils, electric ovens and cookers, and so on. Some heating notes preface descriptive and other illustrated particulars and prices of electric radiators and convectors of various designs.

THE BRITISH ALUMINIUM CO., LTD., 109, Queen Victoria Street, London, E.C.—Sixteen-page pamphlet illustrating the applications of aluminium to plant and accessories for chemical processes. Tables are given of the weight of aluminium sheet, safe pressures for, and sizes and weights of, aluminium tubes.

MESSRS. ALFRED HERBERT, LTD., Coventry.—Monthly review and stock list for January. Thirty-two-page illustrated catalogue of combination turret lathes and tools.

MESSRS. W. GEIPEL & CO., St. Thomas Street, London, S.E.—Priced leaflet of rubber-covered wires and cables, carbons, motor starters and insulating tapes.

MESSRS. SCHAFFER & BUDENBERG, LTD., Whitworth Street, London Road, Manchester.—Three sections of their Catalogue. No. 1, of 20 pages, fully illustrated, gives particulars and diagrams of self-recording pressure gauges; No. 2, of eight pages, relates to g.m. pressure gauge taps, iron siphons, &c.; and No. 20 is a 40-page publication dealing similarly with reciprocating and rotary engine counters. All of the lists contain prices.

MESSRS. KRUPKA & JACOBY, LTD., Chapter Street, Westminster, S.W.—Priced leaflet of half-watt lamps.

THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—Four new publications, No. O.S. 1,771 gives particulars and prices of Osram lamps for automobile, motor cycle and carriage lighting; No. O.S. 1,724 is a well got-up 16-page pamphlet dealing with motor-car lighting by Osram drawn-wire lamps, and gives full tabulated details of such lamps; No. O.S. 1,766 covers the drawn-wire "Striplite" lamps for shop and showcase lighting; No. M 1,762 describes G.E.C. time switches fitted with auto-setting gear which automatically adjusts the time of lighting and extinguishing the lamps according to the season of the year.

THE SUN ELECTRICAL CO., LTD., 118 and 120, Charing Cross Road, London, W.C.—Section "M" of their illustrated abridged price list of small motors, A.C. and D.C., from $\frac{1}{50}$ to 25 H.P., electric drills, polishing machines, sewing machine motors, starters, &c. Copies can be obtained on application.

THE CRYPTO ELECTRICAL CO., 155-159, Bermondsey Street, London, S.E.—Four-page descriptive and illustrated list, with prices, of their new type of variable frequency alternators and motor alternators.

MR. ROBT. W. PAUL, of New Southgate, London, N.—Catalogue Section S, dealing with apparatus for the elementary electrical laboratory, and covering resistance standards, boxes and bridges of all kinds, rheostats of various types, unipivot galvanometers and millivoltmeters, insulation meters, magnetometers, reflecting galvanometers, electrostatic instruments, vibration galvanometers, &c. Besides the bare description of the apparatus illustrated—many of which are of novelty and interest—the catalogue contains a great deal of useful information regarding the experiments for which they are employed, and will be welcomed in every elementary electrical laboratory. Since writing the above we have received Sections A to H of Mr. Paul's new general catalogue of electrical instruments. In view of the importance of the issue, and the interesting features embodied in its arrangement, we will deal with it at some length in our next issue.

THE COVENTRY ORDNANCE WORKS, LTD., Ordnance Works, Coventry.—New issue of their small tool catalogue (84 pp.), including particulars and prices, with illustrations of twist drills, chucking drills, milling cutters, reamers, taps, &c. Four sectional catalogues are also issued dealing with these different classes of tools separately. All classes of drills, wire jobbers' long set, and taper shanks, are arranged in order under the decimal equivalent of the diameter. It is clearly indicated which are in stock and which are not.

MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., Tyssen Street, Dalston, London, N.E.—New "Wotan" battery lamp list (No. W.B.L. 2), containing particulars of numerous types of "Wotan" battery lamps now obtainable. Arrangements have been made by the Committee of the Society of Motor Manufacturers and Traders to standardise lamps for automobile lighting, and the types of lamps listed are in accordance with the recommendations of the Committee as to the correct construction of lamps for automobile lighting. Flashlight, flame, festoon and tubular lamps are also listed in variety, whilst there is a number of lamps suitable for sign lighting, illumination schemes, &c. The "Wotan" automobile headlight lamp has a helical filament arranged so as to bring it in the correct focus of parabolic reflectors, which are used in motor-car headlight fittings. For the convenience of the trade a separate folder has been issued suitable for over-printing with name and address of the retailer, and quantities will be supplied to *bona fide* trade customers.

Calendars and Diaries.—From MESSRS. MAVOR AND COULSON, LTD., of Glasgow, we have received a wall calendar with monthly date slips.

From MESSRS. W. F. DENNIS & CO., we have received a neat and useful morocco wallet, a stamp and card case, and a revised edition of their useful tables and data for wire users. The tables in small compass cover a remarkably wide field, giving all the data regarding wire gauges, the properties of steel, copper, bronze and aluminium wires, and copper bar, reduction tables of weights and measures, and other handy figures that are likely to be required for ordinary purposes, and a good many that are not easily run to earth when wanted.

THE WESTON ELECTRICAL INSTRUMENT CO. have sent us a handy blotter, fitted with calendar, memo. block and squared paper.

THE UNION ELECTRIC CO., LTD., of Southwark, have prepared a large wall calendar with monthly slips for 1914. Union motors for industrial service are prominently in evidence, and photographic views of these and other Union electrical manufactures at work appear on the date slips.

Liquidations and Dissolutions.—PRESTED MINERS' GAS-INDICATING ELECTRIC LAMP CO., LTD., 101A, Elthorne Road, Upper Holloway, N.—Under a compulsory winding-up order the report of Mr. E. C. Bliss, Official Receiver and Liquidator, has been issued to the creditors and shareholders. The accounts filed under the liquidation showed liabilities £2,348, against assets valued at £1,780, and a total deficiency of £18,896 with regard to contributories. According to the Official Receiver's report, the failure of the company is attributed by the directors to the miners' lamp being too expensive to be made commercially profitable. Latterly the bulk of the business of the company consisted of the manufacture of a coil and battery ignition for motor-cars, but when this system was superseded by magneto-ignition the company had not sufficient capital to put a magneto on the market. The company was registered on January 17th, 1903, and was formed to acquire four patents for a miner's electric lamp, which, it was claimed by the inventor (H. G. Prested), was capable of detecting and indicating the presence of gas in coal mines. The promoters of the company, H. G. Prested, John Moule, W. S. Hogg and C. A. Huni, registered for the purpose a syndicate, called the Prested Gas Indicator Syndicate, Ltd., with a nominal capital of £2,500, of which £1,500 was allotted to Prested, as fully paid, as consideration for the sale of the patents. By an agreement, dated

January 1st, 1903 (adopted by the company on February 5th, 1903), between the syndicate and Prested, and M. E. Ames as trustee for the company, this company acquired from the syndicate the patents, with the plant, machinery, stock, and all other property of the syndicate (except cash and unpaid capital). The consideration was £7,500, payable in fully-paid shares, 5,000 to the syndicate or its nominees, and 2,500 to Prested, who was to be managing director for five years at £500 a year. The syndicate undertook to pay its own liabilities, and the cost of obtaining patents in certain countries, or in the alternative to pay £100, and be relieved of those liabilities by this company. On May 16th, 1904, the company entered into an agreement with Prested for the acquisition of a secret process (not patented), in connection with a battery for the patent lamp. Under this agreement Prested was to receive £200, after payment of a 7½ per cent. dividend, and in the event of a 10 per cent. dividend being paid, a further £50. But no dividends have been paid, and the £200 was never paid. The original capital of the company was £12,500 in ordinary shares of £1 each. In May, 1904, the capital was increased to £15,000, by the creation of an additional 2,500 ordinary shares of £1 each; in March, 1905, it was increased to £20,000, by the creation of a further 5,000 ordinary shares, and in April, 1906, it was further increased to £25,000, by the creation of 5,000 preference shares of £1 each. The company has issued altogether four prospectuses. The total issued capital is £18,725, being 16,500 ordinary and 2,225 preference shares, whereof 7,500 ordinary shares were issued as fully paid. The result of the company's trading is shown in the following summary of the profit and loss accounts:—

	Loss.	Profit.
17 months ending July 31st, 1904	£961	
Year ending July 31st, 1905	504	
17 months ending December 31st, 1906	890	
Year ending December 31st, 1907		£50
" " December 31st, 1908		201
" " December 31st, 1909	2,650	

No accounts have been prepared since those dated December 31st, 1909.

Leipsig Fair.—The A.E.G. Electrical Co. of South Africa, Ltd., of Caxton House, Westminster, S.W., inform us that their principals, the A.E.G., of Berlin, will exhibit at the Leipsig Fair from March 2nd to 9th this year. They will be exhibiting on a large scale, including exhibitions of all the latest kinds of electrical heating apparatus, artistic lighting, &c. Letters of introduction to the exhibit at the Fair will be given by the above London office.

LIGHTING and POWER NOTES.

Aberdeen.—The Electricity Committee has recommended the T.C. to reduce the price of current to the Suburban Tramways Co. from 1¾d. to 1½d. per unit, for a period of five years from June 23rd next.

Argentina.—Messrs. Colson, Brookhouse & Pyne have informed the Rosario Municipality that they are not prepared to take up the concession granted them for electricity works in that city under the conditions which have been established by the City Council. It will be remembered that the City Council eliminated all but two tenderers on a first perusal, and then called on these two to improve their conditions, which was done, but one of the two withdrew its offer some time before a vote was taken, and now the last firm that was interested has done the same.—*Review of the River Plate.*

Aylesbury.—The U.D.C. has applied to the B. of T. for consent to construct an electricity generating station adjoining the Canal Basin.

Bathgate.—E.L. Scheme.—The T.C. has granted permission to the Scottish Midland E.S. Co. to introduce a supply of electricity into the burgh, for which purpose a sub-station will be erected in connection with the company's 6,000-volt system.

Bexley.—Street Lighting.—A report of the Electricity and Tramways Committee with regard to the proposed scheme for street lighting by means of 100, 80 and 40-c.p. lamps, states that the scheme is likely to affect a considerable improvement in the lighting of the district. The scheme was adopted with the addition that the surveyor should be empowered to arrange for such variations of the scheme as he considered desirable.

Bolton.—The borough electrical engineer has been authorised to obtain tenders for an ash-handling plant at Back-o'-the'-Bank station.

Bradford-on-Avon.—Prov. Order.—The R.D.C. has decided to consent to the application of Messrs. Seymour, Williams and Co., for a prov. order for E.L. in its area.

Brazil.—Messrs. Escher, Wyss & Co. have recently completed a 20,000-h.p. vertical-shaft turbine for the Rio de Janeiro Tramway, Light and Power Co.'s plant at Pirahy.

Cleckheaton.—The D.C. has decided to invite tenders for an economiser and to request the L.G.B. to grant a loan to cover the cost. The Council has also decided to retain Messrs. Kennedy & Jenkin, of Westminster, to report upon the electricity undertaking.

Carlisle.—Gas *v.* Electricity.—At a recent meeting of the City Council, the Gas Committee brought forward a recommendation that whenever the gas or electricity departments are requested to quote for lighting or power, to either gas or electric consumers, the two engineers, and if necessary the Committees, shall confer before quoting, with a view to preventing unnecessary competition. Naturally the Electricity Committee objected strongly to this proposal, while the chairman of the Gas Committee was in favour of it, and it was in the end passed by 20 votes to 16.

Chiswick.—The E.L. Scheme.—A lively public meeting was recently held to consider the proposals of the Councils in regard to obtaining powers to purchase the local E.L. Co.'s undertaking. Only eight supporters were found for the proposal, while there was an overwhelming vote against it. The question of taking poll is being considered.

Continental Notes.—Denmark.—A representative of the Copenhagen journal, *Politeken*, recently interviewed the director of the North Zeeland Electricity and Tramway Co. in regard to the transmission of electrical energy from Sweden to Denmark. He stated that it would in any case be considerably cheaper to buy energy from Sweden than to produce it in Denmark; negotiations with the Trollhattan Power Co. fell through, and his company had now entered into a contract with the South-Swedish Power Co. for the purchase of 4,000 h.p. The Swedish Co. is at present supplying all the larger towns along the coast of South Sweden, including Malmo, Helsingborg, Landskrona and Trelleborg, and is in a position to supply the additional 4,000 h.p. The transmission will require two cables across the Sound, the first of which will be laid in the course of the summer between the towns of Helsingborg and Elsinore. No particular difficulties are anticipated with these cables, especially as there are at present three telegraph cables in about the same place, which have given no trouble during the past 10 years. The cables will work at 25,000 volts pressure, and will be landed at Marienlyst, to the north of Elsinore, at which place a large transformer station will be erected, and the energy will be transmitted to a second station at Lyngby and then distributed from both stations. The present electrical stations will be kept as reserve stations. There will be practically no reduction in price for small consumers, but the larger ones will benefit considerably. It must, however, be remembered that the Government is proposing a duty on crude oil for Diesel engines, which will affect the price of energy to some extent, and it will be an advantage if an increase of the present price can be avoided. The first part of the project will be completed towards the autumn. It may be remembered in connection with this scheme that the South-Swedish Power Co. recently made provision for a 7,000-h.p. reserve plant, by the construction of a new power station at the Hoganas collieries, where inferior Swedish coal will be employed as fuel.

Norway.—According to the *Jeknisk Ugeblad*, the consumption of electricity in Bergen during last year showed an enormous increase; for lighting purposes it has risen by 53 per cent., and for power purposes by 96 per cent. As regards the consumers, the number of these has risen by no less than 5,800, and the total amount of energy transmitted from the municipal power station at Samnanger amounted to 11 million kw.-hours.

Conway.—Proposed E.L. Scheme.—The Council is considering the question of adopting a system of E.L. Application has been made to the North Wales E.P. Co. for terms for supplying electricity in bulk, which will be discussed at the next meeting.

Cork.—Street Lighting, &c.—The R.D.C. has resolved to ask the B. of T. for an extension of six months for lighting powers for the Monkstown division, in view of the fact that Mr. O. S. Piper is installing E.L. plant at Passage, and will be in a position to contract for the public lighting of the district.

Crewe.—The T.C. has decided to lay a cable to supply electricity to the new sewage disposal works for power and lighting, at a cost of £400.

Cromer.—E.L. Transfer.—The T.C. has agreed with Messrs. Edmundson's Electricity Corporation for the electric light transfer to take effect on March 25th.

Cumberland.—The B. of T. announces in the *London Gazette*, that it has made an order under Sec. 101 of the Cumberland Electricity and Power Gas Act of 1906, for the cesser of all the powers of the Cumberland Electricity and Power Gas Co. as to the whole of the area of supply under the Act.

Deal.—The T.C. has resolved to oppose the Deal and Walmer Gas and Electricity Bill, and has appointed delegates to attend a conference of local authorities interested to consider the Bill.

Ealing.—Auditor's Report.—In his report to the B.C., the auditor states that the electricity supply fund for the past year showed a net profit of £1,970, as compared with £1,317 for the previous year. The credit balance stood at £6,934, and the mortgage debt outstanding amounted to £133,031.

Edinburgh.—Extension of Supply, &c.—The T.C. has approved the draft prov. order to extend its area of electricity supply to include the parishes of Cramond, Corstorphine, Colinton, Liberton and Newton.

In order to cope with the demand for electricity, it will be necessary for the Corporation to proceed this year with the erection of a new generating station, which, together with the plant and mains, is estimated to cost £100,000.

Epsom.—E.L. SCHEME FOR RURAL DISTRICT.—A report to the R.D.C. on the proposed application by Mr. G. Allom for a prov. order to supply electricity at Banstead, Walton-on-the-Hill, and Kingswood, states that the compulsory works proposed are inadequate; that no provision is made for mains for Banstead and Burgh Heath, and that a charge of 8d. per unit is excessive. The Council has also received a letter from Mr. P. Amy, of Tadworth, intimating that he intends to apply for a similar order for Banstead, Woodmansterne, Walton-on-the-Hill, Kingswood and Chipstead, and to lay mains in Banstead, Tadworth and Burgh Heath, and is willing to charge for cottage property, including wiring and current, 3s. per month for four 25-C.P. lamps. The charge generally to the public would be 4d. to 6d. per unit. The Council has agreed to the principle of the scheme, and is prepared to consent to a licence being granted on terms to be arranged.

Fife.—The Fife Coal Co. has introduced an electric lighting scheme at its colliery at Kinglassie. The roads to the pits have been brilliantly lighted, the current being supplied from the colliery plant.

Fivemiletown (Co. Tyrone).—E.L. SCHEME.—It has been decided to raise £12,000 for an electric lighting scheme in the town.

Flint.—PROPOSED E.L. SCHEME.—The T.C. has decided to consider the question of an electricity scheme. The matter has been referred to the Highways Committee in the first instance.

Forres.—E.L. SCHEME DROPPED.—The T.C. has decided to take no further action with reference to the proposed E.L. scheme.

Galashiels.—At a meeting of the T.C. a petition by the Galashiels and District E.S. Co. for a warrant to erect a generating station at Netherdale was remitted to the Works Committee.

Glasgow.—At the last meeting of the Electricity Committee, the question of the Electricity Department hiring out cooking utensils, heating apparatus and other appliances, was remitted to a special sub-Committee to consider and report. The convener and the sub-convener are to confer with traders and others as to the desirability of opening a permanent showroom in the centre of the city for the exhibition of electrical appliances.

Gravesend.—LOANS FOR NEW PLANT, &c.—The T.C. has decided to extend the mains to the works of a local chemical company. By the casting vote of the Mayor, it was decided to apply to the L.G.B. for a loan of £13,600 for electricity purposes, including the installation of a 1,000-KW. steam turbine, with condenser, pumps, &c., coupled to a 6,000-volt, three-phase alternator, together with rotary converters, transformers, and switchgear, and H.T. mains between the works and the Rosherville sub-station.

Great Yarmouth.—STREET LIGHTING.—The electrical engineer has informed the T.C. that as soon as practicable the work of substituting electricity for gas for public lighting at Gorleston will be put in hand.

Grimsby.—PLANT EXTENSIONS.—The Public Lighting Committee has decided to expend £9,550 on additions to the electricity works.

It has been decided to give an extra discount of 5 per cent. off current supplied to Corporation departments; this represents about £52 per annum. The electricity revenue last year amounted to £19,317, including for lighting, &c., £10,271; power, £3,192; Admiralty, £1,191; public lighting, £1,667; and tramways, £2,996.

Halstead.—PROPOSED E.L. SCHEME.—The U.D.C. has sealed an agreement with Messrs. C. C. Pudney & Co., of Bury St. Edmunds, in respect of the formation of an electric light company for the town.

Hastings.—NEW LOANS; STREET LIGHTING, &C.—The Corporation has decided to apply to the L.G.B. for a further loan of £5,000 for mains extensions. It was pointed out that every extension undertaken had yielded a satisfactory profit. The Council has sanctioned the laying of a cable in All Saints' Street in order to convert 58 gas lamps to electricity. The Corporation claims to save 30s. a year on each lamp, the gas company's contract being £3 5s. 8d. per lamp.

Hendon.—The question of adopting slot gas meters in the married quarters of the new fire station has been deferred by the U.D.C. pending a report as to the advisability of adopting electric lighting.

Hinckley.—PROV. ORDER.—The U.D.C. has consented to the proposed application for a prov. order for E.L. of the Midland E.L. and P. Co., the order to include Hinckley, Barwell and Earl Shilton.

Ilford.—NEW SUB-STATION.—A L.G.B. inquiry is shortly to be held into the application of the U.D.C., for sanction to borrow £4,040 for the erection of a sub-station at Goodmayes.

Inverurie.—PROPOSED E.L. SCHEME.—The T.C. has decided to ascertain whether the G.N. of Scotland Railway Co. would consider supplying the burgh with electricity.

Kirby Lonsdale.—PROPOSED E.L.—The U.D.C. has appointed two members and the clerk to go into a draft agreement with Mr. C. H. Best, of Bradford, for an E.L. installation for the town.

Leigh.—PLANT EXTENSION.—Details of the proposed extensions to the electricity works were given at a meeting of the T.C. last week, as follows:—1,500-KW. steam turbine and air filter, £4,750; 1,000-KW. rotary and switchgear, £2,260; cable connections, £200; foundations, £250; steam and exhaust pipes, £300; boiler, brickwork, stoker, superheater, air heater and ducts, fan engines for air auxiliaries, £2,800; condenser, £950—total, £11,910. The extensions are urgent; the output sold during the last nine months has been some 29 per cent. ahead of that sold during the nine months of the previous year.

Leyland.—PROV. ORDER.—The U.D.C. will hold a meeting on the 26th inst. to consider the proposal of the Leyland Gas Co. to promote a Bill authorising it, amongst other things, to supply electricity.

Llansamlet.—STREET LIGHTING.—The P.C. has decided to extend the public E.L. in the parish.

Loftus.—E.L. AGREEMENT SEALED.—The U.D.C. has sealed an agreement with Messrs. Pease & Partners for the supply of electricity for lighting purposes in the district.

London.—FULHAM.—With a view to an improvement in the lighting of High Street, the Electricity Committee has instructed the engineer to substitute 100-C.P. lamps for the existing 50-C.P. lamps throughout that thoroughfare from Fulham Road to Putney Bridge. The Council is being recommended to join the London Electrical Masters' Association.

LOANS FOR ELECTRICITY UNDERTAKINGS.—The Stepney and Bermondsey Councils are being recommended to approve the resolutions passed at a recent conference of London municipal authorities owning electricity undertakings, strongly protesting against the action of the L.C.C. in first altering the maximum periods for the repayment of loans for electricity undertakings, and later in attempting to alter the periods of existing loans, without consulting the Borough Councils concerned.

Malvern.—MAINS EXTENSIONS.—The U.D.C. has decided to extend the mains to the West Malvern district, at a cost of £1,450, provided guarantees are forthcoming.

Manchester.—At a citizens' meeting, held last week, in spite of considerable opposition on the part of the Ratepayers' Association, the proposals of the Corporation to purchase land at Davyhulme for a new generating station, and to purchase the undertaking of the Trafford Power and Light Supply, Ltd., for £146,500, were approved.

Margate.—PUBLIC LIGHTING.—The T.C. has accepted the offer of the Isle of Thanet Electric Tramways Co. for lighting the road along the tramway track at Northdown with 15 100-C.P. lamps, fixed on the tramway pole brackets, at £2 15s. each per annum.

Newcastle-on-Tyne.—The E.L. installation at the Cathedral, put in some 18 years ago, is to be modernised at a cost of about £300

New Zealand.—The Whangarei Council has been authorised to borrow £13,000 for an electricity scheme; the current is to be generated at Wairua Falls.—*New Zealand Shipping and Commerce.*

It is stated that the first 6,000 H.P. of plant at Lake Coleridge is expected to be put into operation by May next. The plant is designed for a total capacity of 12,000 H.P., and will supply the Christchurch City Council and some 15 other local bodies, the electrification of the Christchurch-Lyttelton Suburban Railway, and the requirements of the meat freezing works, flour mills, woollen mills and other industries of the Canterbury Plains. The natural features of Lake Coleridge and the adjacent rivers allow of an extension up to 58,000 H.P. The Christchurch City Council will be enabled to retail power at an average of about 3d. per unit for lighting, and 1½d. per unit for power.

A scheme is under consideration for the supply of electricity to all the towns in the North Island, and it is anticipated that such power might also be used for the electrification of the railways and a system of light railways throughout the country districts.—*Board of Trade Journal.*

Penrith.—PUBLIC LIGHTING.—The U.D.C. has referred the question of the better lighting of the town to a Committee for consideration.

Romford.—The U.D.C. has instructed the clerk to ascertain whether the Council's interests will be adversely affected by the new Bill of the County of London E.S. Co. The Bill affects the Romford and District E.L. Order, 1913.

South Stoneham. — E.L. SCHEME.—The R.D.C. has granted the application of the Southampton Electricity Committee to supply electricity to the parish of Bitterne.

Swansea. — The Education Committee has instructed the electrical engineer to heat the isolation wards at the Training College with electricity. The Council is being recommended to afford the Nobel Explosives Co. a stand-by supply of electricity not exceeding 50 KW. at any time.

Southampton.—LOAN SANCTION.—Sanction has been received from the L.G.B. to the borrowing of £6,000 for services and £11,350 for mains. The Board has transmitted an order permitting the supply of energy to Chilworth. The Eastleigh and Bishopstoke U.D.C. has informed the T.C. that it cannot entertain the Corporation's proposal to supply electricity in its district. The town clerk has been authorised to obtain a prov. order to supply electricity to Bitterne.

Swinton and Pendlebury.—STREET LIGHTING.—The "Barrow" system of street lighting is to be extended over the whole of the tramway route. The capital cost will be about £1,621, and L.G.B. sanction to a loan is being sought for.

Tasmania.—The St. Leonards Municipal Council has decided to light the town by electricity.—*Tenders.*

Taunton.—A REJECTED SCHEME.—At a meeting of the T.C. on January 14th, a scheme to generate electricity at the French Weir, on the Tone, was defeated by a large majority. The estimated cost was £1,600, and the borough electrical engineer stated that if the same amount was spent on the provision of up-to-date steam plant at the present works, he could cut down the cost of coal by 50 per cent.

Teignmouth.—E.L. SCHEME.—At a meeting of the U.D.C. on Tuesday, last week, a letter was received from the Bovey Tracey E.L. Co. with reference to a supply of electricity. A committee reported that it had had satisfactory interviews with Dr. Purves and Mr. W. Bird, and it hoped to place some definite information before the Council at its next meeting.

Troon.—E.L. SCHEME.—The T.C. is objecting to the prov. order of Kilmarnock Corporation with a view to obtaining the best terms possible in connection with the electric lighting of Troon.

Warminster.—PROV. ORDER.—The U.D.C. has consented to a prov. order for E.L. being granted to Mr. J. H. Edwards, of Bristol.

West Yorkshire.—E.L. PROPOSALS.—The following further decisions have been come to by various District Councils, after consideration of a communication from the Yorkshire Electric Power Co., seeking support for its application for powers to supply electricity for lighting purposes:—The Kirkheaton U.D.C. has decided not to support the application; the Bolton U.D.C., after being informed that the Bill did not provide for a compulsory supply of electricity, and as it was considering the advisability of an E.L. scheme of its own, decided to oppose the Bill, and, if possible, take joint action with other Councils; the Wharfedale R.D.C. has decided to allow the company's letter to lie on the table, the opinion being that the Council was being asked to commit itself before it knew anything definite about the proposals; the Gildersome and Rawdon D.C.'s are supporting the application. The West Riding C.C. has taken the view that a most strenuous opposition is desired, owing to the fact that it was suggested that the company should have authority to make arrangements with private consumers for the supply of energy without obtaining the consent of the local authority; the Otley D.C. generally approves, and both it and Meltham U.D.C. are giving the matter close consideration before coming to a decision; the Penistone U.D.C. has decided to support the company without prejudice to its rights of taking out a prov. order itself; the Wombwell U.D.C. has appointed a Sub-Committee to consider the matter to see how far it affects the interests of the district; the Midgley D.C. has decided to support the West Riding D.C. Association in its opposition to the company's application, and the Cudworth U.D.C. is also opposing. The Morley T.C. has authorised the affixing of its seal to a memorial from the non-county boroughs objecting to the proposals, as, if passed, the Bill would create a monopoly in the districts; the Keighley R.D.C., the Oxenhope U.D.C. and the Haworth U.D.C. have affixed their seals to the Bill on account of the promoters being alleged to have failed to comply with the Standing Orders; the Emley U.D.C. has decided to support the company's application, though a strong point was made by the opponents of the company's application in regard to the monopoly which would be set up when once the company got in; and the Featherstone Council has decided to oppose the Bill, taking the view that the rights of supplying electricity should be reserved for itself.

Windsor.—STREET LIGHTING.—The T.C. has sealed a contract with the Windsor Electrical Installation Co. for public electric lighting.

Worcester.—NEW PLANT STARTED.—On Thursday, last week, a new 2,000-H.P. turbo-alternator was started up by the Mayoress. Mr. Robert Clarke, chairman of the Electricity Committee, in welcoming the visitors, pointed out that the demands on the plant, especially for power, had advanced very rapidly, and with a view to securing this valuable load, the Council had agreed to spend £6,000 on the new plant. This was capable of supplying the whole demand of the city, and he mentioned that the air-filtering plant, in connection with it, had been supplied by a local firm, Messrs. Heenan & Froude. He concluded with a tribute to the ability of the borough electrical engineer, Mr. Shaw.

Yeovil.—PROV. ORDER.—The T.C. has decided to object to the application of Messrs. Petter, Ltd., for a prov. order for E.L., with a view to securing conditions as to the Council's option of purchasing the undertaking, prices to be charged, &c.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Tramways Sub-Committee has agreed to recommend the Committee to purchase the Militia Barracks for a new depôt and sheds. The scheme will cost more than the Mannofield scheme, viz., £8,600.

Australia.—The Victorian Legislative Assembly has passed four Bills authorising the construction of new electric tramways round Melbourne, viz., the Brunswick and Coburg, the S. Melbourne (Middle Park), the Camberwell, Hawthorn, and Richmond, and the Kew lines. The costs are estimated at £36,000, £60,000, £63,000 and £70,000 respectively for the complete schemes.—*Australian Mining Standard.*

Bingley.—The new tramway route between Nab Wood and Bingley will be formally opened on February 3rd.

Bradford.—RAILLESS TRACTION.—At the last meeting of the City Council tenders amounting to £13,270 were accepted for the supply of railless cars, chassis and equipment; it is hoped to have at least one of the routes in working order before the Yorks. Agricultural Society's Show in Bradford this year.

Continental Notes.—SWEDEN.—The Swedish Railway Authorities have worked out a plan for extensions and improvements of the State Railways over a period of ten years. This plan has now been submitted to the Government for approval, and it will involve a capital expenditure of no less than £16,667,000. Of the above-mentioned amount it is proposed to expend £2,640,000 on the electrification of considerable sections of the main lines, among which may be mentioned the line between Jörna, Malmo and Trelleborg, and the lines between Stockholm and Gothenburg and Malmo and Gothenburg. It is further proposed to electrify the railway between the large iron mines in the North and the port of Lubac in the Bay of Bothnia, which will require a sum of about £417,000. The continuation of this line from Kiruna to the Norwegian frontier is now being electrified.

ITALY.—A project has been approved for the construction of an electric railway, partly underground, in the town and district of Genoa. There will be 14 stations on the proposed line, of which 10 will be underground.

A syndicate of Italian and Belgian capitalists is applying for a concession to construct and work an electric railway between Modena, Lama and Mocogno.

GERMANY.—The Saxon State Railway authorities have decided to commence the electrification of their system. The first section to be converted will be that between Klingenthal and Untersachsenberg, after which the Pirna-Dresden-Meissen line will probably be taken in hand.

On 16th inst. an express train wrecked a tramcar of the Süddeutsche Strassenbahngesellschaft at a level crossing at Essen a.d. Ruhr. The signalman had omitted to lower the barriers, which move vertically instead of, as in Britain, horizontally; neither of the drivers had therefore any warning of the danger. Three persons were killed and a number injured.

The municipalities of Charlottenburg and Wilmersdorf have called upon the Overhead and Underground Railways Co. to submit plans and estimates for the construction of a promised extension 1·6 mile long under the Kurfürstendamm.

FRANCE.—Up to 1900, when the old Campagnie de l'Ouest electrified one of its lines from Paris to Versailles, only the Compagnie d'Orleans followed its example by installing electric traction on its line between the Gare d'Austerlitz and the Gare du Quay d'Orsay. Since then the latter company has electrified two of its lines as far as Juvisy, and is now about to transform in the same manner the two other principal lines. Up to the present, 13 600-volt D.C. locomotives, of 700 KW., and some motor-trains are in use. In order to complete the electrification, five new 1,500-KW. locomotives are being obtained, which will allow of wholly abolishing steam traction and transferring to Juvisy the machinery depôts, workshops, &c., thus setting at liberty a large area of land in Paris. Energy is supplied from the generating station erected at Ivry in 1900 by the Thomson-Houston Co. The State is also about to make a considerable increase in the number of its electric lines by the conversion of all its suburban lines, which will be worked on the 600-volt third-rail system.

Dublin.—The tramway works at Inchicore, which have been closed for four months owing to the labour disturbances, were reopened this week, the workers being reinstated.

Hastings.—PETROL-ELECTRIC TRACTION.—A few days ago Major Pringle, of the B. of T., visited Hastings for a trial of the system which is to supersede the Dolton cars along the front. One of the existing cars had been converted by the substitution of the Stevens petrol-electric motor in place of the skate. Major Pringle intimated that his report would be favourable. The route over which the new system will run is quite level, and the change from motor to overhead wires at West Marina causes only a moment's delay.

Heywood.—The Tramways Committee has decided that the return half of a workman's ticket, costing more than 1½d., shall entitle the holder to return on a tramcar at any hour of the day.

Ilford.—A TRAMWAY LEASE.—The Tramways Committee is considering the question of insurance against loss of earning capacity owing to disturbance of the system by fire at the electricity works. With reference to the proposed lease of a tramway from the Barking T.C., the U.D.C. has decided to propose the payment to the Barking Council of £900 per annum for the lease of the section, Barking to supply current at 1½d. per unit and to maintain the track and overhead equipment; Ilford to maintain the overhead equipment, and to retain all fares taken, no other authority to run cars on this section. The foregoing arrangement, if adopted, will be for three years from April 1st next, Ilford reserving the right to terminate same in 1915 or 1916.

Leeds.—TRAMWAY EXTENSIONS.—The City Council has approved the tramway extensions and improvements section of the Parliamentary Bill. This portion of the Bill was also approved by a statutory meeting of the ratepayers.

London.—With reference to the report of the Select Committee of the House of Commons on Motor Traffic, the General Purposes Committee has recommended the L.C.C. to concur in the view that in all Metropolitan traffic matters, Parliament should be advised by one authority, combining the traffic duties of the Home Office, B. of T., and L.G.B.; to accept a new B. of T. traffic branch as a suitable authority providing it consists of a small number of competent persons holding office for a considerable period; that county councils within the area of the branch be empowered to submit proposals, and that the branch should inform all parties interested in such proposals that they have been submitted, and, if necessary, hold an inquiry and make by-laws on the subject; that the police should exercise closer control of the traffic; that the police should continue to grant vehicle licences; that traffic points should be provided at a greater number of crossings; that more refuges should be provided; that congestion caused by tramway dead-ends and other obstructions should be removed; and that the Metropolitan Streets Act, 1867, be extended to include the whole Metropolitan area, instead of the six-mile limit.

BERMONDSEY.—The General Purposes Committee has had under consideration the widenings suggested on behalf of the L.C.C., estimated to cost £6,400, in connection with the electrification of the tramways in Southwark Park Road, &c., together with the widenings suggested by the borough surveyor. Neither of these widenings, the Committee states, will permit of a double line of tramway throughout the route, and it has therefore instructed the surveyor to prepare plans showing the necessary widenings for double track, which he estimates at £29,000, and which will be forwarded to the County Council with a request that immediate steps be taken for the electrification of the tramway in question, and for a double line to be laid throughout the route.

The Highways Committee has recommended that a double-line tramway junction be installed from Essex Road to Canonbury Road, at an estimated cost of £4,000, and that the track be obtained from Hadfield's Steel Foundry Co., at a cost not exceeding £2,200; and that a "lay-by" be installed at the junction of East and West India Dock Roads, at an estimated cost of £1,050.

Luton.—Application is to be made to the B. of T. for an extension of two years for completing authorised tramways.

Nelson.—RAILLESS TRACTION.—A deputation, representing the Tramways Committee, visited Leeds and Bradford last Thursday to inspect the railless trolley system, in view of the proposal to adopt this form of traction for the Walverden and Southfield Wards of Nelson.

Poole.—The T.C., on January 16th, decided to formally oppose the Bill of the Sandbanks Railless Electric Car Co., which seeks power to provide railless transport through Branksome Park and Canford Cliffs, and thence to Poole Park, a route of seven miles.

Salford.—A report upon the lowering of the fares and the extension of various routes was considered by the General Purposes Committee last week, and was referred back to the Tramways Committee with certain recommendations.

Swansea.—TRAMWAY EXTENSIONS.—The Light Railway Commission has, subject to the confirmation of the B. of T., made an order for the construction of further light railways in the borough.

U.S.A.—That it pays central stations to provide facilities for the charging of the batteries of electric vehicles is evident from some figures recently to hand. During the year ending April last the Commonwealth Edison Co., of Chicago, was supplying current for no less than 569 electric delivery vans and lorries, the consumption amounting to 3,780,000 KW.-hours. Current was also supplied to a large number of electric pleasure cars, the revenue from the battery load being over £40,000. In New York the Edison Co. has an annual income of £50,000 from current supplied for the recharging of electric motor-lorries, this increasing at the rate of 30 per cent. a year.

Wrexham.—YEAR'S TRAFFIC.—The number of passengers carried on the electric tramways during the past year was 1,227,328, an increase of 179,000 on the preceding year. The receipts amounted to £6,700.

York.—A meeting of ratepayers has approved the proposed Corporation Bill in so far as it relates to railless traction, motor-omnibuses, the extension of electricity undertaking, and the supply of electricity in bulk.

The Light Railway Commissioners will, on February 25th, hold an inquiry into the application of the T.C. for an order for the extension of the tramways.

TELEGRAPH and TELEPHONE NOTES.

Aeroplanes and Wireless.—It is reported that Mr. Marconi has made considerable progress with a system of transmitting wireless messages from aeroplanes, and has taken several flights with Mr. Gustav Hamel.

Canada.—A total of 272,088 wireless telegraph messages, containing more than four million words, were handled by the Canadian Government during the past year at its coast stations. There are now 40 wireless stations in the Dominion.

Mexico.—The existing 18 Telefunken wireless telegraph stations having operated much better than a French system which is also in use, and having assisted materially in the suppression of the rebellion, the Government have ordered several more Telefunken equipments in addition to the two 10-KW. stations now under construction.

Norway.—The wireless station on the Island of Rundemanden, near Bergen, was recently in communication with Cape Race, Newfoundland; this represents the first wireless communication between Norway and America.

A new telephone central is to be erected at Christiania on modern lines, at a cost of £55,000.

Telegraph Wire Thefts.—In the course of a trial last week, it was stated that the P.O. had installed alarms which rang in the linemen's cottages when telegraph wires were cut. Some £2,000 worth of wire had been stolen from the main trunk lines to the North of England.

United States.—Referring to the recent agreement of the American Telephone and Telegraph Co. (Bell Co.) with the United States Government, by which the former undertakes to sever itself entirely from the Western Union Telegraph Co., and pledges itself not hereafter to acquire control over any competing company, the American *Telephone Engineer* quotes with approval an editorial in a Chicago paper, which points out that the combination now dissolved was not in restraint of trade, but for the benefit of trade, and had resulted in better and cheaper telephone and telegraph service, together with various concessions and conveniences to the public. That the telephone and telegraph services constituted a natural monopoly was recognised by the Postmaster-General of the United States, who had previously recommended that they should be purchased and combined under Government control. The outcome of the new conditions, says our contemporary, will be an impulse to independent telephony such as it has not had since competition began in 1894.

The agreement provides for facilitating intercommunication between the Bell company's system and the systems of all other telephone companies in the United States, a concession which the Government had not hoped to gain. There is still a law-suit in progress between the Government and the Bell Co., with the object of dissolving the connection between that company and the Pacific Telephone and Telegraph Co.

The authorised capital stock of the Bell Co., on December 31st, 1912, was about £100,000,000, and its bonded indebtedness £21,000,000. For the past seven years it has paid 8 per cent. per annum. The Western Union Co. had an authorised capital of £20,000,000, of which the Bell Co. held about 30 per cent.

Wireless Telegraphy.—The Postmaster-General has appointed Lieut.-Col. Fowler, commandant of the Army Signalling School, to be a member of the Committee on Research in Wireless Telegraphy, of which Mr. Hobhouse is chairman.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—SYDNEY (NEW SOUTH WALES).—March 18th. For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

March 2nd. Sydney Harbour Trust. Circular Quay. Three electrically-operated semi-portal travelling cranes for Berths Nos. 1, 2 and 3, Woolloomooloo Bay. Particulars from Engineer-in-Chief of the Trust.

March 25th. N.S.W. Railways and Tramways Department.—Five 1,000-KW. sub-station units to specification No. 124. Particulars at Electrical Engineer's Office, 61, Hunter Street, Sydney.—*Tenders.*

ADELAIDE.—February 11th. P.M.G. 50 cable terminals. See "Official Notices" January 9th.

MELBOURNE.—January 24th. Corporation. House cut-out boxes and replacement wedges.—January 21st. 5 tons, 16 cwt. bare hard-drawn copper cable. See "Official Notices" January 9th.

February 17th. P.M.G. Cable boxes. See "Official Notices" January 9th.

April 7th. P.M.G. Accumulator batteries (Tudor) for radio-telegraph stations. See "Official Notices" to-day.

April 7th. For the Postmaster-General. Relays, non-polarised, Stores Schedule 996. See "Official Notices" to-day.

HOBART.—March 2nd. For the Postmaster-General. Telephones, common battery, wall pattern, and table pattern, Schedule T 104. See "Official Notices" January 16th.

Aberdare.—January 31st. Corporation. Four double-deck tramcars See "Official Notices" January 16th.

Ashton-under-Lyne.—January 29th. Covering three Lancashire boilers and pipes, painting boiler house, &c., for the Electricity Committee. Borough Electrical Engineer, Electricity Works, Wellington Road.

Austria.—BRZESZCZE (Galizia).—February 20th. The State Mines Administration at Brzescze invites tenders for a quantity of pumping machinery, with electric driving, including an A.C. synchronous motor, 550 volts, 50 periods, an ampere-meter, three-pole oil switch in watertight iron case, &c. Deposit 5 per cent. Particulars of the K.k. Bergdirection, in Brzeszcze.

Australia. — MELBOURNE. — February 18th. 1,590 opalescent arc lamp globes for City Council. See "Official Notices" to-day.

April 7th.—Deputy P.M.G. Six accumulator batteries for radio-telegraph stations. Apply, High Commissioner in London for the Commonwealth of Australia, 72, Queen Victoria Street, S.W.

Belfast.—January 28th. Harbour Commissioners. Electric cables. See "Official Notices" January 9th.

Belgium.—The municipal authorities of Fieron (province of Liége) have just invited tenders for the concession for the supply of electrical energy for private and public lighting and power purposes in the town.

Birmingham.—February 11th. Electrical stores for a year, for the Birmingham, Tame and Rea District Drainage Board. Mr. J. D. Watson, engineer, Tyburn, Birmingham.

Bolton.—The Electricity Committee is inviting tenders for the supply and erection of ash-handling plant at the Back-o'-th'-Bank Electricity Works.

Cape Colony.—February 28th. The municipality of Paarl, Cape Province, invites tenders for the installation of generating plant by water power. Plans and specifications from the Town Clerk, Municipal Office, Paarl, or from the consulting engineer, Mr. Thomas Stewart, St. George's Chambers, Cape Town. (two guineas). Tenders to Town Clerk.

Cheltenham.—January 31st. Corporation. Twelve months' supply of electric light fittings, and other stores. Particulars from Mr. J. S. Pickering, Borough Engineer, Municipal Offices.

Croydon.—January 26th. Corporation. Stores for Tramway Department. Tramway Manager.

Dundee.—January 30th. Corporation. (*a*) 5,000-KW. steam turbine and alternator; (*b*) condensing plant; (*c*) 750-KW. rotary converter, with transformer. See "Official Notices" Jan. 2nd.

France.—January 31st. M. Wilhelm, Ingenieur-en-Chef des Ponts et Chausées, at Grenoble, is inviting offers from firms willing to enter into competition for the supply and erection of the turbines required for the hydro-electric station at Pont-du-Loup, in the Hautes Alpes.

Greenock.—February 11th. Harbour Trust. 150-ton electric crane. Specification, &c. (deposit £1), from Engineer's Office, Municipal Buildings.

Halifax.—February 16th. Corporation. Stores and materials for the electricity department. See "Official Notices" to-day.

Hammersmith.—February 4th. Corporation. Stores for the electricity department. See "Official Notices" to-day.

Ipswich.—January 31st. Corporation. Alternator, transformers, switchboard and rotary converters. See "Official Notices" January 2nd.

Keighley.—February 7th. Electrician's work for a year, for the Keighley and Bingley Joint Hospital Board. Mr. J. N. Clarkson, clerk, North Street, Keighley.

Leeds.—February 21st. Corporation. Twelve months' supply of coal and other stores, including a number of electrical items. See "Official Notices" to-day.

Leigh (Lancs.).—January 23rd. Corporation. One 1,500-KW. turbo-alternator (impulse type turbine), 1,000-KW. rotary converter, transformers and switchgear. See "Official Notices" Jan. 9th.

London.—L.C.C.—January 27th. (*a*) 6,300 tons of steel girder tramway track rails and fastenings; (*b*) about 1,500 tons of slot rails and conductor tees for the tramways. Mr. G. W. Humphreys, Chief Engineer, County Hall, Spring Gardens, S.W.

January 27th. 584 tons of special section rolled steel bar for magnetic brake shoes. Chief Officer, L.C.C. Tramways, 62, Finsbury Pavement, E.C.

January 30th.—Metropolitan Water Board. Twelve months' supply of electric lamps, wire and accessories, &c. Clerk of the Board, Savoy Court, Strand.

BERMONDSEY.—February 5th. Corporation. Stores for the electricity department. See "Official Notices" to-day.

ISLINGTON.—January 28th. Corporation. Twelve months' supply of electrical and engineers' stores. See "Official Notices" January 2nd.

ST. MARYLEBONE.—February 11th. Corporation. Underground cables, house cables, flexible cords, rubber goods, box compound and insulating materials, &c. See "Official Notices" January 9th.

KENSINGTON.—January 29th. Board of Guardians. Electric lamps and fittings and other stores. Specification, &c., from Mr. W. R. Stephens, Guardians' Offices, Marloes Road, Kensington, W.

Manchester.—January 27th. The Corporation Tramways Committee invites tenders for extensions and alterations at the Hyde Road car-shed. J. Gibbons, architect, 4, St. Mary's Parsonage, Manchester.

January 26th. Tenders are invited for the electric lighting of the Chorlton-cum-Hardy library. City architect (one guinea).

Newport. — February 14th. Corporation. Twelve months' supply of stores for Electricity and Tramways Committee. See "Official Notices" to-day.

New Zealand.—March 26th. The Dominion Portland Cement Co., Ltd.—Hydro-electric plant, Wairua Falls.—Section 1: Hydraulic equipment, including turbines (1,500 H.P. each), governors, penstocks, valves, &c. Section 2: Generators (1,000 KW. each), exciters, automatic regulators, &c. Specifications (£2 2s.) from S. Irwin Crookes, consulting engineer, Auckland.—*Tenders.*

Norway.—February 6th. Norwegian State Telegraph Department. 265,000 insulators. Local representation. Particulars from Tekniske Avdeling, Telegrafstyrelsen, Hasselgaarden, Christiania.—*Board of Trade Journal.*

Pontypridd.—February 9th. Corporation. Stores and materials for the electric light and tramway department. See "Official Notices" to-day.

Salford.—Tenders are invited for electric dinner lifts at the Town Hall. Particulars from Mr. J. B. Broadbent, 15, Cooper Street, Manchester.

Sheffield. — February 3rd. Corporation. Contract No 111. Structural steelwork for carrying coal shoots, coal bunkers and railway sidings over same at Neepsend. See "Official Notices" January 16th.

Spain.—The municipal authorities of Belmez have again invited tenders for the establishment of a central electric lighting station in the town.

Turkey in Asia.—March 14th. Forty years' electric lighting concession for Trebizond municipality. Population 50,000 to 60,000; 12 miles of street lighting. Houses mostly occupied by poorer classes. Water power (Deirmen River) available. An English translation of the conditions may be seen at the Board of Trade Commercial Intelligence Department in London.

West Ham.—February 6th. Corporation. Stores for the electricity department. See "Official Notices" to-day.

CLOSED.

Admiralty.—The Edison & Swan United Electric Light Co., Ltd., Ponder's End, have been appointed contractors to the British Admiralty for ampere gauges from 15 to 500 amperes for the following year.

Ashton-under-Lyne.—The T.C. has accepted the following tenders in connection with the supply of two tramcars:—

United Electric Car Co., Ltd.—Bodies and trucks.
Siemens Bros. Dynamo Works, Ltd.—Equipments.

Australia.—Victoria. P.M.G.'s Department:—

1,768,800 porcelain insulators, pattern B, £19,968.—Commonwealth Art Pottery and Insulator Co., Pty., Ltd.
One common-battery multiple switchboard and equipment, to increase the switchboard at Windsor, from 3,360 to 7,680 lines, £16,534.—British G.E. Co., Ltd.

Home Affairs Department:—

Federal Territory Power Plant.—Engine and condensing plant, £5,512.—Belliss & Morcom, Ltd.
Steam boiler with chain grate stoker and superheater, £1,478.—Babcoc and Wilcox, Ltd.—*Tenders.*

Bedminster.—The Bedminster, Easton, Kingswood and Parkfield Collieries, Ltd., have placed with Messrs. Johnson and Phillips an order for extra-high-tension and low-tension totally enclosed switchgear for surface and underground service.

Belgium.—Six concerns—two each French, German and Belgian—submitted tenders last week to the Société Nationale des Chemins de Fer Vicinaux for the supply of the bronze trolley wire required during the current year. The lowest offer was that of the Société A.E.G. Union, of Brussels, whose prices ranged from 1,785 to 1,800 fr. per metrical ton.

Bentley.—The U.D.C. has accepted the tender of Messrs. W. H. Pease & Co. for installing the E.L. at the offices, at £32 10s.

Bradford.—The Tramways Committee has accepted tenders for the supply of 28 railless trolley cars, and these vehicles will be used for the extended service from Dudley Hill to Bankfoot, and from Laisterdyke along Killinghall Road to Bolton.

The Electro-Mechanical Brake Co., Ltd., of West Bromwich, have received the Corporation order for 30 sets of their "E.M.B." unbreakable jointless grid resistances for railless trolley buses.

The Corporation has accepted the tender of the Admil Electric Co., Ltd., to supply, deliver and erect at the Valley Road Electricity Works, one turbo-generator of 5,000 KW. capacity, running at 1,500 revs. per minute, manufactured by the Bergmann Electrical Works, Berlin, for the sum of £9,370.

The *Leeds Mercury* of Friday last makes the following observations on the matter:—"The Electricity Committee of the Corporation, after paying a hurried visit to Berlin, have decided to recommend the acceptance of a German tender for a large steam turbine plant. All the leading British firms were in competition for the order, some of them at exceptionally low prices, but the decision is understood to be influenced partly by a more speculative guarantee on the part of the German firm, and partly by some prejudice existing against British manufacturers, who have recently associated themselves together in order to obtain fair conditions of contract in municipal work. Possibly there is no firm in Bradford which could produce the plant required, but at all events, certain Yorkshire firms were in the running, and it is understood the differences in the prices were not such as to justify the placing of the contract abroad. As already stated, the question of the guarantee is understood to have been the determining factor. The British makers insist upon a 10 per cent. margin in the matter of fuel consumption and power, whereas many foreign firms take the risk of the rejection of their plant in the event of the specified guarantee not being strictly carried out. Any variation from the British guarantee is, of course, subject to a penalty, but the firms insist upon a 10 per cent. margin being allowed them before rejection. As Bradford is a nursery of labour politics, it is believed that some local protest may be raised against important work going abroad before the question is finally settled by the Council."

Dundee.—The Corporation Sub-Committee, which was appointed with powers, has decided to place a repeat order for a 5,000-KW. turbo-alternator and condensing plant with Messrs. Willans & Robinson, Ltd., and Messrs. Dick, Kerr & Co., Ltd. The other sections for the rotary converters, balancers, &c., of the specification will be dealt with on the result of the tenders.

Glasgow.—The T.C.'s Sub-Committee on Tramways, Works and Stores has recommended acceptance of the following offers:—

Steel conduits and fittings.—Siemens Bros. Dynamo Works, Ltd.
Washed dusters.—James B. Horne.
Electrically controlled clocks for Coplawhill Car Works.—Edward & Sons.
Special track work.—Loraine Steel Co.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

WAR OFFICE.

Electric cells.—J. C. Fuller & Sons, Ltd.
Motors, &c.—Electric Construction Co.
Telephone sets, &c.—International Electric Co., Ltd.; Midland Electric Wire Co., Ltd.; Siemens Bros. & Co., Ltd.; Spagnoletti, Ltd.; Walter's Electrical Manufacturing Co., Ltd.
Supply and erection of cables, Royal Gunpowder Factory, Waltham Abbey.—W. T. Henley's Telegraph Works Co., Ltd.

INDIA OFFICE: STORE DEPARTMENT.

Wireless telegraph apparatus.—Marconi's Wireless Telegraph Co., Ltd.
Cables.—London Electric Wire Co. and Smiths, Ltd.
Electrical plant.—Siemens Bros. Dynamo Works, Ltd.

CROWN AGENTS FOR THE COLONIES.

Electric cranes.—Craven Bros., Ltd.

POST OFFICE.

Telegraphic apparatus.—Tyler & Co., Ltd.
Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd.; B.I. and Helsby Cables, Ltd.; British L M. Ericsson Manufacturing Co., Ltd.; International Electric Co., Ltd.; London Electric Wire Co. and Smiths, Ltd.; Western Electric Co., Ltd.
Telephonic cable.—W. T. Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.; Siemens Bros. & Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.
Porus cells.—Siemens Bros. & Co., Ltd.
Fans.—Pitter's, Ltd.
Fuses.—Western Electric Co., Ltd.
Insulators.—Doulton & Co., Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; B.I. & Helsby Cables, Ltd.; F. Smith & Co. (inc. in London Electric Wire Co. and Smiths, Ltd.).
Galvanized iron wire.—Dorman, Long & Co., Ltd.; Rylands Bros., Ltd.; F. Smith & Co. Wire Manufacturers, Ltd.
Conduit work, Eastern and South-Eastern district.—Callender's Cable Co., Ltd.
Installation and jointing of loading coils, London-Birmingham cable.—Western Electric Co., Ltd.
Laying lines of multiple-way ducts, Cardiff-Swansea.—(Section 1) W. H. Worthington, Ltd.; (Section 3) W. Dobson; Manchester-Bolton, W. Pollett & Co.; Manchester-Burnley (Section 1), J. A. Ewart, Ltd.; Manchester, Burnley, Bury (Section 3), W. H. Worthington, Ltd.; Newcastle-North Shields, R. Fisher.
Laying lines of single-tube ducts, multiple-way ducts and pipes, London-Brighton.—(Section 1) J. A. Ewart, Ltd.
Telephone exchange equipment, Wrexham.—Automatic Telephone Manufacturing Co. Ltd.

Great Yarmouth.—The T.C. has accepted the tender of Messrs. E. Foster & Co. for 2,000 tons of Bestwood ½-in. washed slack, for the electricity works; and that of Rose & Co. for 1,000 tons of screened steam coal.

The T.C. has also accepted the tender of Crompton & Co., Ltd., for a high-tension switchboard, at £883.

Grimsby.—The Public Lighting Committee, on Monday, accepted the tender of Messrs. Berry, Skinner & Co., for starting apparatus at £38 for one starter or panel of each size; also that of Messrs. Horace Green & Co. for motors, the price for one motor of each size being £167.

Harrogate.—The T.C. Education Committee has accepted the tender of Messrs. Charles Bell, of Bradford, for the installation of the electrical equipment at the new Council Schools in Skipton Road, Harrogate.

Holland.—Messrs. Edward Bennis & Co., Ltd., of Little Hulton, have received an order from their representatives in Holland, for a bucket elevator and a U-link chain conveyor, including distributing shoots, for Leidschendam power station.

London.—FULHAM.—Corporation. The Electricity Committee has received the following tenders for a 2,500-KW. turbo-alternator and condensing plant:—

——	Turbine.	Alternator.	Turbo and alt.	Condenser.	Complete set.	Time of deliv'ry
	£	£	£	£	£	
Richardsons, Westgarth and Co.	—	—	5,894	2,135	7,925	9 to 10½ months
Jas. Howden	4,250	—	7,310	—	—	8
Vickers, Ltd.	—	1,750	—	—	—	
A.E.G. Electric Co. ..	—	—	5,550	1,750	7,300	7½
" " " "	—	—	—	—	7,800	7½
Butler & Co.	—	2,044	5 834	—	7,624	7½
Rees Roturbo Co.	This firm quotes for air pump only.					
Elec. Equip. and Eng. Co..	—	1,885	—	—	—	9
W. H. Allen & Co.	—	—	—	1,980	—	6
Dick, Kerr & Co.	—	—	5,863	—	—	10½
Cole, Marchent & Morley	—	—	—	2,085	—	4
British Thomson-Houston.	—	—	6,656	—	—	6
" " "	—	—	6,150	—	—	6
Siemens Bros. & Co. " ..	—	2,440	—	—	—	7
" " ..	—	2,510	—	—	—	—
General Electric Co. ..	—	2,079	—	—	—	7
Parsons & Co.	3,675	—	5,875	2 202	8 077	9
Willans & Robinson ..	—	—	5,580	1,975	7.890	9
Musgrave & Co.	2,657	2,137	4,794	2,127	6,921	10
British Westinghouse Co..	3 282	2,467	5,765	1,943	7,395	9
" " ...	—	—	6,014	—	7,867	9
Worthington Pump Co. ..	—	—	—	1,785	—	6
Fraser & Chalmers.. ..	3,250	—	—	—	—	6½
British Electrical Co. ..	—	—	7,650	1,725	9,175½	9
Oerlikon Co.	—	—	5,257	1,811½	7,068½	9
Escher, Wyss & Co. ..	—	—	5,704	2,042	7,706	8
Mirrlees, Watson & Co. ..	—	—	—	1,897	—	8
Isaac Storey & Co.	—	—	—	1,870	—	5
Belliss & Morcom	4,215	1,800	6 015	2,425	8,440	10½
Daniel Adamson	—	—	6,283	2,132	8,415	9½

The electrical engineer submitted an exhaustive report and analyses of the tenders, and acting on instructions interviewed the representatives of the British Thomson-Houston Co. and the Worthington Pump Co., with the result that their tenders were reduced to £5,900 and £1,746 respectively. The Committee states that in selecting the most advantageous tender, apart from the actual price, due regard having been paid to the kilowatt capacity, steam consumption, area of condenser, period of delivery and facilities for testing, &c., it recommends that the tenders of the British Thomson-Houston Co. and the Worthington Pump Co. be accepted, particularly as the two turbo-alternators previously supplied by the B.T.H. Co. have proved so satisfactory.

L.C.C.—The Stores and Contracts Committee reports the acceptance of the following tenders during the Christmas recess:—

For Electric Fittings, Schedule 14:—
Atlas Carbon & Battery Co., Ltd.—Items 5 (*a*) to (*d*) and 6 (*a*) to (*e*).
British Central Elec. Co.—Items 14, 16 and 20.
B.I. & Helsby Cables, Ltd.—Items 7 (*a*) to (*c*).
Cooper & Roberts.—Items 1, 4, 17 and 18.
Dorman & Smith.—Items 8 and 9.
Elliott Bros.—Items 22 (*a*) to (*f*), 23 and 24 (*b*).
General Electric Co., Ltd.—Items 3 (*a*) to (*h*), 12, 15, 21, 25, 26 and 30.
Siemens Bros. Dynamo Works, Ltd.—Items 2, 19, 27 (*a*) to (*c*), 28 and 31 (*a*) to (*c*).

For Electric Insulating Materials, Schedule 15:—
L. Andrew & Co.—Items 9 and 11.
W. Geipel & Co.—Items 2 and 4.
J. N. Hardy & Son.—Items 12.
L.-R., G.-P. and Telegraph Works Co., Ltd.—Items 5 and 6.
J. G. Ingram & Son.—Items 8 and 10.
Micanite and Insulators, Ltd.—Items 1 and 8.
Siemens Bros. & Co., Ltd.—Items 7.

The Committee recommends the acceptance of the tender of the General Electric Co., Ltd., for the supply of insulated screw-eyes, schedule 14, item 10.

The Highways Committee reports the receipt of the undermentioned tenders for the provision of control gear and recording apparatus for use in testing motors at the central car repair depôt:—

Edison & Swan United Elec. Light Co., Ltd.	(accepted)	£70 10
L.-R., G.-P. and Telegraph Works Co., Ltd.		73 15
Nalder Bros. & Thompson, Ltd.		77 15
British Westinghouse Elec. & Manfg. Co., Ltd.		91 10
Johnson & Phillips, Ltd.		106 0

The Highways Committee reports the receipt of the following tenders for the provision of steam, exhaust, condenser, feed, &c., piping, water-tanks, &c., at the Greenwich generating station:—

Brightside Foundry and Engineering Co., Ltd. .. .. (recommended)	£5,489
Staveley Coal and Iron Co., Ltd.	5,979
Edward Le Bas & Co.	6 280
Butterley & Co., Ltd.	6,634

The Committee recommends that the Brightside Foundry and Engineering Co., Ltd., be allowed to sub-let to Stewarts & Lloyds, Ltd., the steam and other high-pressure pipes; to Jas. Oakes & Co. the circulating pipes, and to Newton, Chambers & Co. the hotwells,

STEPNEY.—The Borough Council Electricity Supply Committee recommends that the tender of Messrs. J. Smart & Son, Poplar, E., be accepted for the supply of 50 tons of moulded pitch, at £2 7s. 9d. per ton, for the use of the Electricity Department.

Leeds.—The City Council has accepted the tender of Mr. W. J. Turnbull for the erection of a new tramcar depôt at Guiseley for £14,050, and the work is to be completed within six months.

Leigh.—The tender of Messrs. Babcock & Wilcox, Ltd., for a water-tube boiler, £2,800, has been recommended for acceptance by the Electricity Committee.

Luton.—The T.C. has accepted the tender of Messrs. Johnson & Phillips, Ltd., at £1,419, for extra-H.T. switchgear.

Manchester.—The Chloride Electrical Storage Co., Ltd., have secured an order from the Corporation for a battery of 264-B N.W. cells, with a capacity of 2,760 ampere-hours at the 1-hour rate, or 5,520 ampere-hours at the 10-hour rate. The battery will be used in connection with a traction load.

Manchuria.—Messrs. A. W. Penrose & Co., Ltd., have received the contract to supply four large alternating-current electric goods lifts for the Manchurian Railway.

New Zealand.—GISBORNE.—The Electrical Committee has recommended the B.C. to accept the tender of Messrs. Ferranti, for meters, at £522.—*N.Z. Shipping and Commerce.*

Northampton.—The Tramways Committee has accepted the following tenders:—

Stark, Ltd.—Far Cotton extension scheme and doubling of a portion of Kingsthorpe track, £20,352.
Brush Electrical Engineering Co.—Bodies and trucks for seven cars.
Dick, Kerr & Co.—Electrical equipment for seven cars.

Penketh.—Messrs. Johnson & Phillips, Ltd., have received an order from the Penketh Tanning Co., Ltd., for a D.C. generator, balancer, switchboard, overhead and underground cables, &c., for supply of their tanning works at Penketh.

Southampton.—The T.C. has received the following tenders for supplies of tram rails:—

	100 tons of B.S.S. No. 4, at per ton.	20 tons of B.S.S. No. 4 C, at per ton.	Additional price per ton for Sandberg quality.
North-Eastern Steel Co., Ltd. (accepted)	£6 12 6	£6 12 6	5s. 0d.
Walter Scott, Ltd	7 0 0	7 0 0	5 0
Bolckow, Vaughan & Co., Ltd.	7 0 0	7 0 0	5 0
Lorain Steel Co., Ltd.	7 3 6	7 13 6	2 6

The following tenders have also been received for the supply of a steam turbo-alternator:—

Name.	Turbine.	Alternator.	Price.
Willans & Robinson, Ltd.	Willans	Vickers	£4,190
		Siemens Bros.	4,340
		Gen. Electric Co.	4,300
		Bruce Peebles	4,650
		Brown, Boveri	4,600
		Electric Construction Co.	5,355
Brush Electrical Engineering Co., Ltd.	—	—	4,021
C. A. Parsons & Co., Ltd.	Parsons	Parsons	4,297
Dick, Kerr & Co., Ltd.	—	—	4,932
James Howden & Co., Ltd.	—	Siemens	4,585
		Brown, Boveri	4,695
		Gen. Electric Co.	4,518
		Bruce Peebles	4,890
Richardsons, Westgarth & Co., Ltd.	—	Brown, Boveri	3,900
		Electric Construction Co.	4,650
British Westinghouse Electric and Manufacturing Co., Ltd.	—	—	3,858
Belliss & Morcom, Ltd.	Belliss	Vickers	3,928
		Bruce Peebles	4,414
		Siemens Bros.	4,069
		Gen. Electric Co.	4,067
		Electric Construction Co.	5,041
Fraser & Chalmers, Ltd.	—	Siemens, G.E.C. or Vickers	3,932
Escher, Wyss & Cie.	Zoelly	Siemens Bros.	3,893
		Brown, Boveri	4,132
British Thomson-Houston Co., Ltd.	—	—	4,084
H. W. Butler & Co. (London), Société Anonyme des Ateliere de Constructions Electriques du Nord et de l'est Jeumont (Nord)	Zoelly	A.C.E.N.E.	4,067

St. Albans.—For installing the electric light at the workhouse and infirmary, the B. of G. received the following tenders:—

C. C. Pudney & Co., Bury St. Edmunds (accepted)	£212
Brooks & Wolse, London	221
Mr. P. T. King, Luton	254
Francis Reade & Co., Finchley	294
Pinching & Walton, Cannon Street, E.C.	255
Miskin & Rice, St. Albans	287
Electric Installation, Ltd., London	388
Electric Wiring and Accessories Co., St. Albans	399
Kent & Co., Sunderland	247
Lund Bros. & Co., London	249
Bustin's Electric Works, Barking	553
Giffen Bros., St. Albans	408

Willesden.—The Guardians have accepted the tender of the Electric Contracts Co., at £262, for the installation of inter-telephonic communication at the workhouse. Several other tenders were received ranging from £324 to £369.

FORTHCOMING EVENTS.

Physical Society.—Friday, January 23rd. At 5 p.m. At the Imperial College of Science, South Kensington. Ordinary Meeting.

Junior Institution of Engineers.—Friday, January 23rd. At 8 p.m. At 39, Victoria Street. Paper on "Engineering Contracts and Concessions in South America," by Mr. T. Rich.
January 24th. Week-end visit to Birmingham, to meet the Midland Section Members.
Friday, January 30th. At 8 p.m. At 39, Victoria Street. Paper on "Practical Notes on Electric Cranes and other Handling Plants," by Mr. F. E. Chilton.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, January 23rd. At 6.30 p.m. At Armstrong College. Annual Dinner.
Friday, January 30th. At 7.30. At Bolbec Hall, Newcastle. General meeting.

Manchester Association of Engineers.—Saturday, January 24th. At Grand Hotel, Aytoun Street. Paper on "Power Production," by Mr. E. G. Hiller.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, January 24th. At 4.30 p.m. At Royal Technical College, Glasgow. Paper on "Specifying and Buying Electrical Mining Plant," by Mr. J. P. C. Kivlen.

Electrical Trade Union.—Monday, January 26th. At Memorial Hall. Meeting of members, delegates, &c.

Institution of Electrical Engineers (Newcastle Local Section).—Monday, January 26th. At 7.30 p.m. At Armstrong College of Science. And on Friday, January 30th. At 7 p.m. At Hugh Bell School, Middlesbrough. Paper on "Reactance and Reactance Coils in Power Circuits," by Mr. E. P. Hollis.

Institute of Marine Engineers. Monday, January 26th. At 8 p.m. Discussion on paper on "The Working Arrangements for the Combustion of Oil Fuel in Marine Boilers," by Mr. Gander.

Institution of Civil Engineers.—Tuesday, January 27th. At 8 p.m. At Gt. George Street, Westminster. Paper on "Superheating Steam in Locomotives," by Mr. H. Fowler.
Friday, January 30th.—At 8 p.m. Students' meeting.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, January 27th. At 7.30 p.m. At the University Physical Laboratory. Paper on "Electric Train-lighting Systems," by Mr. T. Ferguson.

London Electrical Masters' Association.—Tuesday, January 27th. At 8 p.m. At Caxton Hall, S.W. Meeting.

Institution of Mechanical Engineers.—Wednesday, January 28th. At 7.30 p.m. At Philosophical Hall, Park Row, Leeds. And on Friday, January 30th. At 8 p.m. At Engineering Theatre of the University. "Thomas Hawksley" Lecture on "Water as a Mechanical Agent," by Mr. E. B. Ellington.

Institution of Electrical Engineers (Students' Section).—Wednesday, January 28th. At 7.45 p.m. At Victoria Embankment. Paper on "Recent Advances in Portable Wireless Telegraph Apparatus, with Demonstrations," by Mr. P. R. Coursey.

Institution of Electrical Engineers (Birmingham Local Section).—Wednesday, January 28th. At 7.30 p.m. At the University, Edmund Street. Paper on "Electric Train-lighting Systems," by Mr. T. Ferguson.

Nottingham Society of Engineers.—Wednesday, January 28th. At Welbeck Hotel, Milton Street. Paper on "Microscopical Examination of Metals," by Mr. J. T. Goodwin.

Association of Electrical (Station) Engineers.—Wednesday, January 28th. At 7 p.m. At Stone's Restaurant, Ludgate Hill, E.C. First annual smoking concert.

Concrete Institute.—Thursday, January 29th. At 7.30 p.m. At Denison House, 296, Vauxhall Bridge Road, S.W. Discussion.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, January 26th.—"A" Company. Technical instruction, 7 to 10 p.m.
Tuesday, January 27th.—"B" Company. Technical instruction, 7 to 10 p.m.
Wednesday, January 28th.—Recruits only. Infantry drill and technical instruction, 7 to 10 p.m.
Thursday, January 29th.—"C" Company. Technical instruction, 7 to 10 p.m.
Friday, January 30th.—"D" Company. Special class on Crossley engine, 7 to 8 p.m. Technical instruction, 7.30 to 9.30 p.m.
Saturday, January 31st.—Headquarters will be opened for regimental business only from 10 a.m. till 12 noon.

(Signed) F. R. HOLT-WHITE, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

The Strike at Holborn.—The strike of electrical and other workmen engaged upon the Pearl Assurance Building, in Holborn, which was ended last week on a supposed undertaking by the main contractor that in future no non-Union electrical workman should be employed on the work, broke out again on Wednesday this week, objection being taken to a non-Union workman and his assistant employed by Messrs. Duncan Watson and Co., the sub-contractors. We understand that no such assurance as is referred to above was given, and that the electrical work is completed, save for a few finishing touches upon which the workman objected to was employed on Wednesday.

British Thomson-Houston Testing Department.—The fourth annual dinner and smoking concert of past and present members of the above will take place in Rugby on February 14th. The chair will be taken by Mr. J. M. Ralph. All past members wishing to attend, and who have not been notified already through the post, are asked to communicate with Mr. H. Silvester, care of B.T.H. Co., Ltd., Rugby, at once, for further particulars.

LEGAL.

DAY v. WILLARD AND OTHERS.

Ruthenberg Electric Furnace.

IN the King's Bench Division, on Thursday, January 15th and the ensuing Friday, Saturday and Monday, Mr. Justice Pickford, sitting without a jury, heard an action brought by Wm. Thomas Day, of Caxton Cottage, Shepherd's Bush, against Mr. Chas. Danne Willard, of Cromwell House, Surrey Street, Strand, Mr. Fredk. Henry Haviland, of Bournemouth, and Mr. Otto Stalmann, of Tavistock Square, Bloomsbury, claiming certain declarations of title to a share of profits derived by the defendants by the sale and exploitation of an invention called the Ruthenberg electric furnace. The defendants denied liability to the plaintiff.

For the plaintiff Mr. Patrick Hastings and Mr. Wallington appeared, and defendants were represented by Mr. Schiller, K.C., and Mr. Whateley.

MR. HASTINGS, in opening Mr. Day's case, explained that the plaintiff, in his claim, set forth that in January, 1911, Mr. Marcus Ruthenberg was the owner of a patent process for electric smelting, and the defendant, Otto Stalmann, was the agent of Mr. Ruthenberg, for the purpose of selling or otherwise exploiting the patent. In January, 1911, the defendant Stalmann, on behalf of Mr. Ruthenberg, introduced the patent to the plaintiff for the purpose of plaintiff forming a limited company to work the patent, and in July, 1911, it was verbally agreed between plaintiff and the defendants that they should all become partners and work together for the forming of the proposed company, and that all profits to be derived by the defendants from the formation or from Ruthenberg, or in respect of work incidental to the forming of the company, should be divided equally between the plaintiff and the defendants By a letter dated August 24th, 1911, Ruthenberg agreed with the plaintiff that in consideration of the services to be rendered by him in connection with the company, he (Ruthenberg) would permit plaintiff to receive, or would allot to him, all the deferred shares of the company, and plaintiff said he held that letter as trustee for himself and the defendants. The plaintiff and defendants formed a company under the name of the North-Eastern Electric Smelting Co., Ltd., about Nov. 29th, 1911. Plaintiff said that defendants received from Mr. Ruthenberg all the deferred shares of the company, and defendants had failed to pay to plaintiff his proportion of the shares. Plaintiff said he had rendered to defendants all the assistance in his power in forming the proposed company, and he had done all that was necessary to enable him to claim the benefit of the verbal agreement, and he said that in October, 1911, his rights under that agreement were wrongfully terminated by Ruthenberg through the defendants, and that the benefits were transferred to the defendants.

The plaintiff further said that if there was any delay in the formation of the company it was caused by the fault of Mr. Ruthenberg, and he said that in breach of the agreement, Mr. Ruthenberg failed to procure a grant from the Newcastle-on-Tyne Electric Supply Co., Ltd., to the proposed new company and a lease of certain premises, and also concealed from the plaintiff material information as to the terms upon which electric current could be supplied. In the alternative, plaintiff said he introduced Mr. Stalmann and the patent to Willard and Haviland for the purpose of the formation of the company upon the implied terms that defendants should pay him a quarter share of the profits to be derived by the defendants for such introduction and for the aid rendered by him in the formation of the company. The defendants had wrongfully refused to give him such remuneration.

MR. HASTINGS remarked that his Lordship would see that the plaintiff put his case in various ways, but in substance he claimed that he was entitled to a fourth share of the profits that the defendants had made in exploiting the Ruthenberg patent process, and the claim was based on an agreement made between them all that they would share the profits obtained by the exploitation of the patent which was introduced by Day through the defendant Stalmann to the other two defendants. Mr. Willard and Mr. Haviland were to finance the enterprise of forming the company. Mr. Stalmann was the representative of the patentee, so that Mr. Day stood between the patentee on one side and the financiers on the other. Mr. Day's case was that the defendants went behind his back and got from the patentee similar documents that he held, and which excluded him (plaintiff) from his agreed share in the profits. Mr. Willard was a financier, and was interested in certain mining properties in Wales and Cornwall, and the original idea was to use the furnace in connection with these mines, and it was agreed that plaintiff and the three defendants should equally share the profits. Ultimately the scheme was altered, and there were negotiations with a Mr. Esselmont, who was connected with the Newcastle Electric Supply Co., the idea being to use the furnace there. Matters proceeded, and the company was in due course formed, largely through the efforts of the plaintiff, but plaintiff now said that the defendants eventually combined together to get rid of him. They made various complaints against him, and then went to the patentee and got the document that it was alleged excluded the plaintiff from the benefits that it was agreed he should have.

MR. HASTINGS argued that it was clearly established upon the correspondence that the plaintiff and the three defendants were co-adventurers in this matter, and they agreed definitely to share all the profits. Other questions that might arise as to whether the company that was in fact formed, was the one that it was originally intended to form at an earlier date, were really immaterial.

MR. DAY gave evidence in support of his case, and emphatically stated that it was agreed that he and the three defendants should share the profits that resulted from the enterprise. The original idea was that the invention should be used in connection with various mining properties in Wales and Cornwall, but this was not carried out because of the expense that would be involved in the erecting of power stations. When attention was directed to the Newcastle-on-Tyne scheme, Mr. Willard introduced Mr. Haviland, whom witness understood was a solicitor and a director of one of Mr. Willard's companies. Witness stated that it was first proposed that the capital of the new company should be £100,000, but this money could not be raised, and the figure was very substantially reduced. Witness denied that he ever undertook to arrange for the capital for the new company, and asserted that this was entirely the province of Mr. Willard.

Cross-examined by MR. SCHILLER, K.C., Plaintiff said that the proposed capital of £100,000 was reduced to £75,000, and subsequently to about £35,000. The great expense that would be involved in erecting power stations in Wales and Cornwall was a factor in the abandonment of the West Country scheme.

MR. SCHILLER: You are suggesting here that these three gentlemen are trying deliberately to defraud you out of your profits?—Well, that is a nasty way of putting it.

But that is your case?—Yes, I suppose it is.

Plaintiff further stated that he believed Mr. Stalmann was a professional gentleman, an engineer occupying a very high position, and he admitted that of Mr. Stalmann he had written that he was "incapable of telling a lie." Witness also said that Mr. Willard was introduced to him as a person of high repute.

Questioned as to the work of finding capital for the new company, plaintiff strenuously denied that he ever acknowledged that he had undertaken this.

At the close of the plaintiff's cross-examination, MR. SCHILLER submitted that there was no case, but

MR. JUSTICE PICKFORD said he would not stop the case at that juncture, but would hear the evidence for the defence.

MR. SCHILLER then addressed his Lordship, and said that the defendants' case in substance was that the story told by Mr. Day was untrue. Counsel said that Mr. Willard was a gentleman who was largely interested in certain mines which were worked privately, and he and Mr. Haviland had had considerable experience in dealing with business of this kind. The facts of the case were that Mr. Day had been tinkering with this Cornish scheme, because Mr. Ruthenberg, who had parted with all his patents except for Cornwall, had a mine there which he was anxious to develop, his idea being to work the mine and put up his own furnace there, but the scheme came to nothing, because the expense would be too great, involving the building of a power station, and the large sum of £100,000 was wanted. The plaintiff had unsuccessfully tried to get the money, and he got out another scheme, which was hardly more successful than the other. When he came into contact with Mr. Willard, he talked a good deal about the financial interests with which he was connected, and he told Mr. Willard that he could find the money that was needed to exploit the patent, but he wanted somebody who could put his scheme into order and see it through. He had no office, and he wanted this accommodation and the help of experienced gentlemen who could put his rough scheme into proper shape. He said he could get help from his financial friends, and he left his scheme at Mr. Willard's office. Both Mr. Willard and Mr. Haviland assisted him, and the real trouble arose because the plaintiff failed to find the money in the way that he had suggested he could. As time went on, Mr. Ruthenberg got very annoyed because the promises made were not being carried out, and a squabble arose over the fact that Mr. Ruthenberg had omitted to mention certain matters as to the contract with the representative of the company at Newcastle, who were to have a supply of power and let certain premises. This occasioned some delay and considerable trouble, and Mr. Day had admitted that eventually matters came to a time of crisis. The option was expiring, and everybody concerned met at Cromwell House, and on this occasion Mr. Willard asked plaintiff direct how he was getting on with the finance. The position of Messrs. Haviland and Willard was that unless there was an extension of the option by Mr. Ruthenberg, all their labour would have been in vain, as if Mr. Ruthenberg was so minded he could have said to them: "The option is terminated—you have spent your time and money on a good thing which I shall leave in your hands no longer." Mr. Day at that interview admitted that he had done nothing. Mr. Ruthenberg said he would not allow Mr. Day to have anything further to do with the scheme, and would not renew the option to him. Counsel went on to say that in reply to the suggestion that he had not carried out his obligation in the matter of finding capital for the company, Mr. Day put forward two circumstances: (1) That he had been hampered by illness; and (2) that it was the fault of Mr. Ruthenberg, because delay had been occasioned by the fact that he had concealed two important conditions in the contract that should have been given in the prospectus particulars. Mr. Schiller said his Lordship would hear from Mr. Stalmann and the others that at the meeting referred to plaintiff admitted that it was his business to find the money, and that he had failed to do so, and he then put forward the two reasons already referred to. It would be positively denied by Mr. Willard and Mr. Haviland that it was ever suggested there should be a partnership upon the basis of which a claim of this description could be maintained. This electric furnace was a very good invention, largely in use. Mr. Ruthenberg was in the position of having a good asset to sell, and as he did not want his name to appear as vendor, he put it in the hands of Mr. Day to sell, himself getting a certain price, Mr. Stalmann getting something, and Mr. Day his own share. The matter

was carried out eventually in the way best suited for the parties concerned, Mr. Day figuring as vendor, having all the shares, and distributing them to those who were entitled to receive them for their services. It was an ordinary simple commercial transaction. Mr. Schiller said that if there was no partnership, as was alleged, there was an end of the case. If there was any complaint in regard to the Newcastle contract and scheme, it could not possibly affect the three defendants; that was entirely a matter between the defendants and Mr. Ruthenberg.

Mr. Schiller first called the defendant Mr. Stalmann, who said he was a mining engineer, and the manager of the North-Eastern Electric Smelting Co., Ltd., and he had been interested in such furnaces for a great number of years. He was acquainted with Mr. Ruthenberg, and early in 1911 he was introduced to plaintiff, who conversed with him generally about the Ruthenberg furnace and the finding of money for the exploitation of the invention. Plaintiff said he had a number of influential friends who could advance money that might be required for a scheme, and at that time the Cornish scheme was considerably debated. The first suggestion was that the capital of the company should be £100,000, and this was subsequently modified to £60,000, and then £35,000, but this scheme eventually fell through. Subsequently the Newcastle scheme came under discussion, and in connection with that it was proposed to form a company, the money to be got together by the plaintiff, but he failed to do this. There was no arrangement made of any kind by which the plaintiff and he should share profits with the two defendants as suggested.

In cross-examination, Mr. Stalmann said he understood Mr. Day only had the responsibility of finding the capital. Mr. Ruthenberg gave as a reason for refusing to renew the option he had granted to the plaintiff, the fact that he had promised to find the capital and had failed to do so.

Further cross-examined, Mr. Stalmann said that other reasons were given by Mr. Ruthenberg for his action, but he (Mr. Ruthenberg) did not appear to trust the plaintiff generally.

The defendant Mr. Haviland, also gave evidence, stating that he was a solicitor not in general practice. When the Newcastle scheme came before his notice he understood that he and Mr. Willard were asked to look thoroughly into its details and provide an office. Witness went into the various agreements and other technical matters, and considerably revised and altered the scheme. Witness gave detailed evidence of the various financial arrangements that were made, and said that eventually Mr. Day acknowledged his failure to collect the capital, and pleaded that he had been hampered by illness and by certain delay that had occurred because of Mr. Ruthenberg's omission to state certain facts concerning the Newcastle contract. Mr. Ruthenberg was angry with the plaintiff, and he ultimately gave the option to Mr. Stalmann.

The defendant Mr. Willard, deposed that he was a director of mining companies, and he met plaintiff in 1911, when Mr. Day came to his office with reference to the Cornish scheme. Witness told him that if it was a question of financing a scheme he could not attend to it, being busily engaged with other matters, but Mr. Day said he was prepared to find the capital; it was a question of having an office and getting somebody who would put the scheme into proper shape. Mr. Willard denied that in connection with the Cornish scheme he was to find capital, and he said that no arrangement was come to with the plaintiff as to the sharing of possible profits. Witness corroborated the previous evidence as to the interview at which Mr. Day said he had been unable to get the capital, and at which Mr. Ruthenberg said he would not renew the option to him.

Mr. Marcus Ruthenberg, the inventor of the Ruthenberg electric furnace, gave evidence that he was a mining engineer and was the inventor of an electrical smelting furnace and process in respect of which he had granted an exclusive licence to an English company, except as applied to the county of Cornwall. In 1910 he was the owner of a mine near Falmouth, and he was anxious to develop the property in relation to his patent electrical furnace. The plaintiff was introduced to him as a person who could control large capital, and for some time the Cornish scheme was under consideration, but it was eventually dropped on account of expense. Subsequently witness suggested the Newcastle project, as there were good premises vacant there that were suitable for the purpose of the patent, and there were considerable negotiations with Mr. Esselmont, of the Newcastle Electric Supply Co., Ltd. He had given an option to the plaintiff, because he did not desire to appear as vendor, and eventually the time of the option expired before Mr. Day had got the capital together, as promised. At the meeting held at Cromwell House, he expressed extreme dissatisfaction with Mr. Day. It was totally untrue to say that the defendants persuaded him to refuse to renew the option to the plaintiff. The fact was that the defendant, Mr. Stalmann, pressed him to renew it to Mr. Day, but he declined to do so.

This completed the evidence in the case, and counsel proceeded to address his Lordship upon the legal aspects of the evidence.

Mr. Justice Pickford eventually reserved judgment.

Tramcar Accident Claims.

At the Wakefield County Court, before his Honour Judge Greenhow, an action was brought by Arthur Clapham Milner, coal agent, of Wakefield, against the Yorks. (West Riding) Electric Tramway Co., in respect of personal injuries sustained in a collision with one of the defendant company's cars. He claimed £100 damages.

According to the evidence submitted by Mr. Felix Palmer, who appeared for the plaintiff, it appeared that on April 5th, 1913, Milner was driving his coal cart along Westgate Common, when, owing to negligent driving by the defendant company's motorman, a tramcar ran into it from the rear, throwing the plaintiff out. He sustained serious injury from the fall.

Mr. Greene contended, on behalf of the company, that there was no negligence, as the driver of the car had been slowly passing a motor-wagon, and whilst doing so was repeatedly ringing his bell. As soon as he got clear of this vehicle the plaintiff's cart turned on to the tramlines, and, though the driver of the tramcar pulled up at once, a projecting sack of coal was caught and the accident was caused. Had the cart kept off the lines no accident would have happened.

His Honour gave judgment for the plaintiff for £60.

In the Nisi Prius Court, Dublin, judgment was given for the defendants, with costs, in an action in which Mrs. Catherine Carton, 9, King's Inns Street, sued the Dublin United Tramways Co. to recover damages in respect of the death of her husband, James Carton, in July last. The jury found that the motorman of the tramcar was not guilty of negligence, but that the deceased had shown want of care in avoiding the tramcar, which was travelling at a slow rate.

Intimation was made in the Court of Session of the settlement of an action for £500 damages for the death of a child, against the Musselburgh and District Electric Light and Traction Co., Ltd., the sum of £60 and expenses having been paid.

NOTES.

Science Masters' Exhibition.—A small but interesting exhibition of scientific apparatus (particularly educational) was held under the auspices of the Association of Public School Science Masters, at the Imperial College of Science and Technology (South Kensington), on January 13th and 14th. Among the exhibits of electrical interest were many which have already been noticed in these columns in connection with the recent Physical Society Exhibition. In addition, however, Messrs. Siemens showed a good range of standard instruments (including their portable substandard potentiometer), and a very serviceable instrument stand for lecture table and demonstration work. Any instrument to be used in a vertical position is mounted on a baseboard of standard size, and, as required, the latter is slid into grooves in the vertical member of a wooden stand of inverted-T section.

Messrs. W. G. Pye & Co. exhibited, for the first time, their new multi-range potentiometer, in which is embodied a ratio box, so that the total range of measurement is from 1 micro-volt to 440 volts. The total resistance of the ratio coils is 20,000 ohms, and the arrangement of the whole is such as to prevent heating of the potentiometer coils due to the high voltage applied to the ratio coils. The general arrangement of the instrument is similar to that of the well-known "Granta" potentiometer, but sliding stops have been added on the jockey-bar, so that accidental displacement of the jockey becomes impossible, and readings can be repeated with certainty. Movement of the jockey to obtain balance against the standard cell before and after a reading is obviated by tapping off a portion of the slide wire for this purpose. Balance against the cadmium cell is obtained by turning the circuit switch to "Std. Cell" and depressing a special key. The slide wire is extended to give 0·101 volt drop, thus avoiding repeated changes from one switch connection to the next when working around an exact tenth of a volt (or its multiples). An accuracy of 1 in 5,000 is guaranteed. The same firm exhibited well-made cheap forms of reversing switch, school potentiometers, indicating and reflecting galvanometers, and a very useful type of coarse and fine adjustment wire rheostat.

Messrs. Brown & Son exhibited new types of electric muffle and tube furnaces employing nichrome heating elements, set in alundum cement and packed in eternite and magnesia. The muffles themselves are of pure fused silica. Temperatures up to 1,100° C. are obtainable, the current consumption being 2 amperes at 200 volts for a D-muffle 3½ in. high, 4½ in. wide and 6½ in. deep.

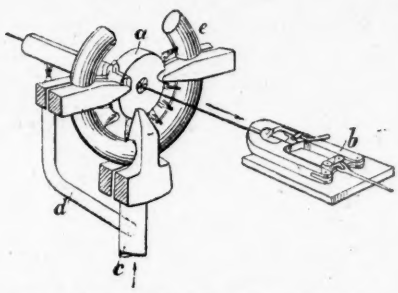
The numerous exhibits by Mr. R. W. Paul included a new electric calorimeter for the determination of Joule's equivalent and resistance temperature coefficients; sub-divided paper condensers with rotating knob key switches, obviating the use of loose plugs; and improved forms of tangent galvanometers, and, as an adjunct or for independent use, magnetometers with very effective air damping. There were also shown a unipivot lecture-room outfit with transparent scale instrument and projector, a useful slide wire and bridge attachment and the McEwen magnetic balance.

Tramcar Controllers.—It is announced in the January issue of the *Journal* of the Tramways and Light Railways Association that as a result of a letter received by the Association from the Board of Trade, a special Committee (consisting of Mr. A. L. C. Fell (chairman), Mr. C. W. G. Little and Mr. A. H. Pott) has been formed to go into this matter.

The Manufacture of Metal-Filament Lamps.—In the *Génie Civil* an abstract is given of a paper by M. Ruff in the *Journal* of the German Society of Engineers, describing the process of manufacture of tungsten filaments.

The metallic tungsten is obtained, as a rule, in the form of a fine powder; not easy to agglomerate, and even when the agglomeration has been effected, the metal thus obtained is not ductile enough to allow of drawing. The metallic powder, therefore, is first heavily compressed in a steel mould, from which a very fragile bar results; the bar is heated carefully in a tubular furnace, the temperature being gradually raised to red heat, and then to a higher degree than that employed in the chemical preparation of the tungsten powder, in a current of hydrogen. The bars are afterwards subjected to "vitrification" at a temperature of 2,850° C. in an electric furnace, on leaving which they are grey in colour, and of a coarse crystalline structure. During this process the metal contracts about 14 per cent.

The bar is then sufficiently strong to be drawn down by hammering or rolling, an operation which is usually effected by



Hot Die for Drawing Tungsten Wire.

means of a special machine which strikes very rapid blows, at a temperature of about 1,300° C. When the diameter of the bar has thus been reduced to about 0·75 mm., the metal is sufficiently ductile to be drawn cold; but preference is given to heated dies, such as that illustrated above. The diamond die *a* is fixed at the centre of a support carrying a heating tube *e*, fed with gas from the pipe *c*, convergent gas jets impinging upon the die-holder. The wire is gripped in a tongs *b*, and before reaching the die passes through a straight tube heater fed with gas from the branch pipe *d*. By progressive drawings the wire is thus reduced to a diameter of 0·025 mm., being passed successively through 100 dies, hot at first and cold in the later stages.

The finished wire is said to have a tensile strength of 420—460 kg. per mm.^{2} (266—292 tons per sq. in.). The last process before mounting the wire in a lamp is to reheat it in a current of hydrogen, to remove the thin layer of oxide with which its surface is tarnished.

Annual Dinners and Socials.—The seventh annual dinner of the Doncaster tramways and electricity staff and employés was held at the Guildhall, on Tuesday, January 13th, Mr. E. S. Rayner, general manager, presiding. The Mayor and the Lady Mayoress, as well as a number of Councillors and the borough surveyor, were among the guests. After dinner a most enjoyable programme was gone through, which included songs by Mrs. Rayner, a monologue by Mr. Rayner, duets and solos by members of the staff, and songs rendered by Mr. F. B. Suthery (of the General Electric Co.), all of which were very much appreciated. After the concert a small play was performed by some members of the staff entitled "Area Belle." The remainder of the evening was occupied in dancing.

Fatalities.—A young electrician, named Louis J. O'Rourke, met with his death in the motor garage works of Messrs. Wayte Bros., Lemon Street, Dublin, on Thursday last week. The deceased, who was in the employment of the General Electric Co., Trinity Street, Dublin, had been at work endeavouring to remedy a defect in the electrical apparatus of the lift, when something broke, and O'Rourke received such terrible injuries that he expired almost immediately.

Charles Walker, aged 23, of Kimberley, was killed at Digby Colliery on 16th inst. He was engaged as a coal tipper, and came in contact with a live lighting wire above his head. Death was instantaneous.

Educational Notes.—At the Technical College of Trondhjem, a special laboratory is to be established for carrying out experiments in connection with the utilisation of water power for the production of electrical energy. This laboratory will cost more than £21,000. The necessary electrical energy will be supplied by the town of Trondhjem in the form of three-phase current at 6,300 volts.

At the Akbar Nautical School, Heswall, a complete Marconi installation has been put in, and the scholars are being trained to use both the field and long-distance apparatus.

Accident.—A trimmer named Hills was seriously injured at the Southend Electricity Works last Sunday week owing to his clothing being caught in some pumping machinery.

Institution and Lecture Notes.—Association of Electrical Station Engineers.—A meeting was held at Birmingham on January 13th, at which resolutions were passed in support of the Weekly Rest-Day Bill, and vigorous protest was made by the meeting against the inclusion in Electric Supply Bills of a strike penalty clause. The branch has made excellent progress, having increased its membership by over 50 during the last month. A smoking concert has been arranged for February 3rd.

The Bradford Section recently held a meeting at Huddersfield in accordance with a resolution of the Committee to hold meetings in all the important towns in Yorkshire. The objects of the A.E.S.E. were explained, and an appeal made for new members by Mr. R. D. Spurr. Huddersfield is one of the few places where station engineers enjoy a six-day week of employment. On January 15th a meeting of the London Section was held at Stone's Restaurant, Ludgate Hill, E.C. The Weekly Rest-Day Bill was discussed, and resolutions were passed in support of it. Nominations were received for the election of the London District Committee, which in the past 12 months has been the Organising Committee for the whole of the country, but will now deal with London district business only, an Executive Committee having already been elected to represent the whole of the country. Arrangements have been made to hold monthly meetings as above, on the second Tuesday in every month. A smoking concert has been arranged at the same address, on January 28th.

Society of Engineers.—On Monday, February 2nd, at the Institution of Electrical Engineers, Mr. Arthur Valon, M.Inst.C.E. (President, 1913), will present the premiums awarded for papers published in the *Journal* during 1913. Mr. H. C. H. Shenton, the President for 1914, will then deliver his Presidential Address.

Royal Society of Arts.—Two lectures on "Electrical Vibrations and Wireless Telegraphy" have been given by Mr. R. P. Howgrave-Graham, in the course of which many interesting phenomena and uncommon experiments were demonstrated.

Junior Institution of Engineers.—On Monday Mr. H. H. Thorne read a paper on "Modern Gearing," dealing especially with worm and double helical gearing.

Institution of Electrical Engineers.—The subject of the Kelvin lecture delivered last night by Sir Oliver Lodge, D.Sc., F.R.S., was "The Electrification of the Atmosphere."

Institution of Post Office Electrical Engineers.—On Tuesday Mr. Trotter read his paper on "Overhead Wire Construction for Medium and Low Pressures," printed in full elsewhere in this issue, and an interesting discussion followed, in which many supply station engineers took part. A report of the discussion will appear in a later issue.

British Electrical and Allied Manufacturers' Association.—On Wednesday the annual dinner of the Association took place at the Savoy Hotel. There was a large attendance, and the proceedings were animated and enthusiastic. The President, Lord Ampthill, occupied the chair, and was supported by Lord George Hamilton, Mr. F. E. Smith, Mr. A. Bruce Anderson (chairman of Council), Mr. W. Duddell, and other leaders in the worlds of industry and politics. The principal features of the speeches were the importance of placing British contracts with British works, and the equipment of the electrical laboratories of Hong Kong University by members of the Association. The report will appear in our next issue.

Appointments Vacant.—Works superintendent, for Southampton Corporation Tramways (£150); assistant electrical engineer for Singapore Electric Tramways, Ltd. ($300 per month); assistant representative for the Publicity Department of Sheffield Corporation (£91). Particulars are given in our advertisement pages.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Swindon T.C. has appointed Mr. F. Newey, of Rawtenstall (Lancs.), as electrical engineer on the staff of the electricity and tramways department.

Mr. H. W. Everett, electrical engineer to the Clacton-on-Sea U.D.C., has met with an accident. Whilst he was starting an engine there was a back fire, with the result that his left arm was broken.

Mr. F. L. Pedley, test engineer at the Bradford Corporation electricity works, has taken up the position of electrical engineer to Bingley U.D.C. There were 117 applicants.

Mr. J. M'Entee, Belfast, has been appointed assistant electrical engineer to the Urban Council of Dundalk.

The Poplar Borough Council is making the following increases in the salaries of its employés in the electricity department:—F. Tait, assistant manager, £250 to £262 10s.; V. H. Cruickshank, station engineer, £225 to £237 10s.; E. R. Ingram, mains engineer, £225 to £237 10s.; E. E. Farrance, sales manager, £212 10s. to £225; C. A. O'Neal, assistant sales manager, £162 10s. to £175;

A. H JACKS, meter superintendent, £140 to £150; F. W. CROMPTON, draughtsman, £140 to £150; H. THISTLETHWAITE, charge engineer, £181 10s. to £185; P. C. G. WESTLAKE, do., £162 10s. to £175; W. E. PLOWMAN, do., £162 10s. to £175; J. FORSYTH, do., £150 to £162 10s.

MR. C. P. SMITH, junior charge engineer and switchboard attendant at the Bermondsey electricity works, has resigned his appointment. Mr. W. B. SMITH, switchboard attendant, is to be promoted to fill the vacancy at a salary of £98 16s. per annum, rising by two annual increments to £115.

MR. NICHOLS MOORE, the borough electrical engineer of Newport (Mon.), has recommended that station superintendents and senior and junior engineers-in-charge be transferred from the wages sheet to the salaries list. He also recommended considerable increases in salary in nearly every case. The recommendations for transfer were approved, but the recommendations for increases in salary were referred back, together with all other recommendations for increases in salary in the various departments of the Corporation, for further consideration. The Council has also placed on record its appreciation of the services of the chief engineer and staff in connection with the recent extensions, and granted a substantial honorarium to the chief engineer, and deputy engineer, together with a bonus to certain other members of the staff and workmen.

Tramway Officials.—The general staff of the Torquay Tramway Co. has presented a smoker's outfit, in crocodile case, to MR. H. HOLLIDAY, engineer and manager, in appreciation of his kindness and to commemorate the record year of 1913.

MR. HARRY C. MCKAY, draughtsman of the Aberdeen Corporation Tramways, who has received an appointment under the Preston Corporation Tramways, was presented by the office staff and others with a set of water colours. Mr. Forbes, traffic superintendent, made the presentation, in the absence of Mr Pilcher, manager.

MR. THOS. G. MARSH, of the staff of the Chatham and District Light Railway Co., who has been appointed chief inspector of the Maidstone and District Motor Services, has been presented by his colleagues with an umbrella and leather pocket case.

The Ilford U.D.C. has appointed MR. J. C. RICHARDS, of Erith, as chief inspector of tramways. There were 51 applicants for the post.

The Birkenhead T.C. has appointed MR. CYRIL CLARKE, who has been acting tramways manager from June to December last, as manager.

The London C.C. on Tuesday appointed MR. G. W. KNIGHT, as superintendent of the central car repair depôt in the tramway department, at a salary of £300 per annum. Mr. Knight has been temporarily engaged as superintendent since June, 1913.

General.—MR. G. T. BAXTER has taken over the electrical engineering business of Messrs. G. T. Mayfield & Co., of Pier Avenue, Clacton-on-Sea. Mr. Baxter has been with the firm for 27 years, and for the past eight years has managed the local branch.

MR. E. N. FREER GRANT has severed his connection with the firm of Messrs. Grant & Blake, Ltd., Clapham Junction, and has secured an appointment with the Battersea Borough Council in its electricity department.

MR. WALTER H. TITTENSOR, general manager of the West India Electric Co., Ltd., has recently lost his young son by death under tragic circumstances. The boy, Lindsay, aged 9, attended a costume party at Kingston, Jamaica, and his costume caught fire. He received injuries which caused his death. Mr. Tittensor was formerly Corporation electrical engineer at Dundee.

MR. F. W. CARTER, of the British Thomson-Houston Co.'s railway staff at Rugby, who recently paid a visit to the United States, has been appointed corresponding member on the American I.E.E. Railway Committee, and on the Railway Standardising Sub-Committee; he is, we believe, the only person outside the United States on either of these bodies.

A 1914 Detroit electric vehicle was presented to MR. EDISON as a Christmas gift by Mr. Henry Ford, president of the Ford Motor Co., of Detroit, Michigan. It is the Model 47 built by the Anderson Electric Car Co., of Detroit, Mich., is mounted on the worm-gear chassis, and contains every luxury and modern improvement.

MR. JOHN S. LEESE is resigning the position of publicity engineer to the British Westinghouse Electrical and Manufacturing Co., Ltd., and at the end of February will join the Osborne-Peacock Co., Ltd., advertisers' agents, Manchester.

Obituary.—MR. J. A. PENDLINGTON.—The death has occurred, at Newcastle-on-Tyne, of Mr. John Atkinson Pendlington, a well-known engineer. He was born at South Shields in 1861, but spent many of his early years in the United States. When he returned to this country he took service under the Harton Coal Co., Ltd., South Shields, whom he served until 1893, when he was appointed secretary to the Electrical Coal-Cutting Contract Corporation, Ltd., under the chairmanship of Sir Lindsay Wood, Bart. Later he acted as assistant manager to the late Mr. W. T. Goolden, of the firm of Messrs. Easton, Anderson & Goolden, Ltd., engineers, of London and Erith. In 1900 he was appointed secretary to the Typewriting Telegraph Corporation, Ltd., of London, and later he founded the Tyneside Supply Co., Newcastle-on-Tyne, which subsequently became the British Electrical and Manufacturing Co., of Newcastle and London.

NEW COMPANIES REGISTERED.

Parmiter, Hope & Sugden, Ltd. (133,406).—This company was registered on January 16th, with a capital of £15,000 in £1 shares (11,500 pref.), to take over the business of electrical engineers carried on by V. Hope and V. H. Sugden, as Parmiter, Hope & Sugden, at Hulme Electrical Works, Ellesmere Street, Hulme, Manchester. The subscribers (with one share each) are:—V. Hope, Glen Cottage, Macclesfield, electrical engineer; V. H. Sugden, 68, Talbot Road, Old Trafford, Stretford, electrical engineer; W. N. Sugden, Donnybrook, Wilmslow, Cheshire, secretary. Private company. The number of directors is not to be less than two or more than five; the first are V. Hope, V. H. Sugden, and W. N. Sugden. V. Hope and V. H. Sugden are managing directors, and may retain office while holding 500 ordinary shares. qualification of ordinary directors, 100 shares; remuneration as fixed by the company. Secretary, W. N. Sugden. Registered office, Hulme Electrical Works, Ellesmere Street, Hulme, Manchester.

Bishop's Castle Electric Light and Power Co., Ltd.—Prospectus only of proposed company, filed January 15th. Capital, £2,500 in £1 shares. Proposed directors:—G. W. Summers, Penn Fields, Wolverhampton; F. H. Hinde, Oaks Crescent, Wolverhampton; H. Donaldson, Cannock; F. S. Turner, Woodlands, Dudley; H. O. H. Wenman, Wolverhampton (will join the board after completion of the works). Secretary, G. Tomlinson. Registered office, 79, Lichfield Street, Wolverhampton.

Electromechan Co., Ltd. (133,418).—This company was registered on January 17th, with a capital of £500, in £1 shares, to take over the business carried on by W. W. Lower and H. F. Eddrup at 25, Red Lion Street, Holborn, E.C., and to carry on the business of electrical and mechanical engineers, &c. The subscribers (with one share each) are:—W. W. Lower, 86, Huntley Street, St. Pancras, N.W., electrical and mechanical engineer; H. F. Eddrup, 98, Mildmay Road, Romford, Essex, mechanic. Private company. The number of directors is not to be less than two or more than five; the first are W. W. Lower and H. F. Eddrup; qualification, 250 shares. Registered office, 25, Red Lion Street, Holborn, E.C.

Irish Towns Electric Light and Power Co., Ltd. (4,087).—This company was registered in Dublin on January 16th, with a capital of £5,000 in £1 shares (2,000 pref.), to carry on the business indicated by the title. The subscribers (with one share each) are:—J. G. Moore, Drumbed, Cregagh, Co. Down, electrical engineer; M. Curran, 3, Kent Street, Belfast, electrical engineer. Private company. The first directors are M. Curran, J. Moore, J. A. Shannon, S. Finney and W. Garmany. Registered office, 1, Wellington Place, Belfast.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Guildford Electricity Supply Co., Ltd.—Issue on January 8th, 1914, of £5,000 debs., part of a series of which particulars have already been filed.

Walton & Clough, Ltd.—A memorandum of satisfaction in full on November 19th, of mortgages dated November 4th and 14th, 1913, securing £472 each.

R. Herbert & Co., Ltd.—Two debs. dated January 2nd, 1914, to secure £100 each, charged on the company's undertaking and property, present and future, including uncalled and unpaid capital. Holders: R. N. Herbert, 35, St. Martin's Road, Stockwell, S.W., and J. Hall, 78, Devonshire Road, Palmer's Green, N.

CITY NOTES.

Llandudno and Colwyn Bay Electric Railway, Ltd.

THE directors' report for the year to November 30th, 1913, states that the profit, after providing for operating and administration expenses and interest on debenture stock, amounts to £7,764, plus £1,258 brought forward, making a total available balance of £9,021. Of this there has been applied in redemption of debenture stock in January, 1913—£1,347, in providing for sinking fund instalment, due January, 1914, £1,403, in writing off balance of discount and expenses of issue of debenture stock, £1,374, leaving £4,895, which the directors recommend should be applied in payment of a dividend at the rate of 4 per cent. per annum (payable, less income-tax, on January 31st, 1914) £3,976, carrying forward £919. The traffic receipts show an increase of £1,511, and the operating and administration expenses a decrease of £185, as compared with the previous year. The sinking fund in connection with the debenture stock has been provided out of the revenue for the year, and the directors consider that this provision is sufficient to meet the depreciation of the system. A settlement has been arrived at with the Colwyn Bay Council with regard to the widenings in connection with the extension to Old Colwyn, and the construction of this extension will be commenced at an early date. The line is now being doubled at the top of Penrhyn Hill, and the doubling from the end of Mostyn Avenue to the North-Western Hotel in Llandudno will shortly be undertaken. The completion of this work will further increase the facilities for dealing efficiently with the heavy traffic during the summer months.

Bank Rate.—The Bank Rate was yesterday reduced from 4½ to 4 per cent.

Continental.—NORWAY.—At a recent meeting of the Norwegian A/S Elektrometal, at Christiania, it was decided to liquidate. The company was formed a few years ago for the purpose of exploiting the Norwegian patents of the Swedish Elektrometal furnace in Norway, but owing to the failure of these furnaces at the Hardanger Electrical Iron Works, *i.e.*, with coke as fuel, the fate of this type was decided, and, therefore, there is no longer

any need for the company's existence. The assets, which chiefly consist in shares in the Hardanger Electrical Iron Works are going to be taken over by the A/S Elektrokemisk Industri, and there will remain about 40 per cent. of the capital for distribution among the shareholders after all liabilities having been paid.

A new company under the name of the Westinghouse Norsk Elektrisk Aktieselskap has been formed and was filed with the Registrar at Christiania on January 2nd. As is indicated by the name it is a branch of the large Westinghouse firms at Manchester and Pittsburg, which previously were represented by another firm in Norway. The business has during recent years increased to such an extent, that the British and American firms have found it necessary to establish an independent Norwegian company as their representative in the country.

SWEDEN.—It is reported from Stockholm that the Elektrothermiska A./B. has decided on an extension of capital from £155,555 to £266,666, and the public has, in accordance therewith, been invited to subscribe the additional amount. The majority of the shares are owned by the Hydraulic Smelting Corporation, Ltd., in London, or rather the subsidiary company of the same, viz., the Electric Smelting Co., of Scandinavia.

FRANCE.—La Société de l'Union Electrique, of Sainte Claude (Jura), reports a net profit of £13,910 for the financial year ending June 30th last. Of this sum, £4,662 is being applied to depreciation, £459 to legal reserve, £8,000 to a 5 per cent. dividend to the shareholders, £746 to a special building fund reserve, leaving a small balance to be carried forward.

The report of the Société Westinghouse, of Paris, for the last financial year shows a net profit of £4,228, which reduces the amount standing to the debit of the profit and loss account to £8,693.

BELGIUM.—A new company has just been formed in Brussels, with a capital of £4,400, and the title La Société Cinematographie et Electricité.

GERMANY.—The Bochum-Gelsenkirchen Bahn Gesellschaft is the name of a new company which has just been formed, with a capital of £400,000, to acquire and carry on the electric tramway between Bochum and Gelsenkirchen from the Rhenish-Westphalian Electric Co. Interest in the new concern lies in the fact that 37 per cent. of the shares are being taken up by the municipal authorities of Bochum, a similar number by the Gelsenkirchen authorities, 1 per cent. by the Westphalian Provincial Council, and 25 per cent. by the Rhenish-Westphalian Co.

RUSSIA.—The Russian electrical interests of the Deutsche Bank represented by the Elektrischen Licht und Kraftanlagen A.G. have been extended by the recent formation of the Russische A.G. für Electrische Rayonstationen. Its capital of R. 4,000,000 has been fully subscribed. The administration is domiciled in the offices of the Gesellschaft für Electrische Beleuchtung, whose managing director is the business manager of the new company.—*Elektrotechnische Nachrichten.*

Stock Exchange Notices.—The Committee has ordered the undermentioned to be quoted in the Official List :—

Rangoon Electric Tramway and Supply Co., Ltd.—Scrip, £48 per cent. paid, for £100,000 5 per cent. mortgage debenture stock.

Applications have been made to the Committee to appoint a special settling day in, and to grant a quotation to :—

Castner-Kellner Alkali Co., Ltd.—Further issue of 250,000 shares of £1 each, fully paid, Nos. 500,001 to 750,000.

Marconi's Wireless Telegraph Co., Ltd.—Further issue of 250,000 ordinary shares of £1 each (issued at £2 5s. per share premium), fully and partly (£1 10s.) paid (being 10s. capital and £1 premium), Nos. 1,000,001 to 1,250,000.

To appoint a special settling day in :—

British Electric Transformer Co., Ltd.—Further issue of 16,825 ordinary shares of £1 each, fully paid, Nos. 119,115 to 135,439, and 31,588 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 30,391 to 50,000 and 150,001 to 161,988.

Humphrey Pump Co., Ltd.—3,000 additional ordinary shares of £1 each, fully paid, Nos. 130,001 to 133,000.

And to allow the following to be quoted in the Official List :—

British Electric Transformer Co., Ltd.—61,988 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 50,000 and 150,001 to 161,988.

Compania de Electricidad de la Provencia de Buenos Aires, Ltd.—175,000 7 per cent. cumulative participating preference shares of £1 each, 10s. paid.

Hong Kong Tramway Co., Ltd.—325,000 shares of 5s. each, fully paid, Nos. 1 to 325,000.

Singapore Electric Tramways, Ltd.—400,000 shares of 5s. each, fully paid, Nos. 1 to 400,000.

Companies struck off the Register.—The following companies have been struck off the Register and are accordingly dissolved :—

Anglo-French Turbines.
"Brak bricks."
British Electro-Metallurgical Products Co.
British Rubber Regenerating Co.
Engineering Digest Publishing Syndicate.
Heat, Light and Power Syndicate.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended November 28th, 1913, amounted to 965,848, compared with 817,119 units in the corresponding four weeks of 1912. For the four weeks ended December 26th, 1913, the units delivered amounted to 952,773, compared with 806,132 in the corresponding four weeks of 1912.

Brazilian Traction, Light and Power Co., Ltd.—The directors have declared a dividend of 1½ per cent. on the ordinary stock.

Mexican Companies.—A circular in the following terms has been issued by the Mexican Light and Power Co., Ltd., and the Mexico Tramways Co. :—"The conditions of affairs in Mexico, as you are aware, have not improved during the last three months. For some years past the dividends on the ordinary stock have been declared and paid quarterly, which the board has felt justified in doing while conditions were normal and the financial arrangements and profits for the whole financial year could be estimated with a degree of certainty. As, however, the board find it impossible to form any opinion as to when normal conditions will be restored, they are bound to conserve the company's resources and await an improvement in the financial conditions and the Mexican rate of exchange before considering the further distribution of profits, and, therefore, the payment of dividends [in the case of the Light and Power Co. the words 'on the ordinary stock' appear here] will be discontinued. The board are pleased to state that, notwithstanding the unsatisfactory conditions, the operation of the company's business in Mexico shows satisfactory results."

Japan.—The Tokio Electric Co., of Tokio, reports a net profit of no less than £43,145 for the last financial year. Of this sum, £1,837 is being placed to reserve, £10,700 distributed in dividends to the shareholders, plus a bonus, which absorbs £7,133 ; the directors and auditors receive £1,700, leaving a balance of £21,775 to be carried forward.

British Columbia Electric Railway Co., Ltd.—The directors have declared a dividend at the rate of 5 per cent. per annum on the preferred ordinary stock for the half-year ended December 31st, together with an additional dividend at the rate of 1 per cent. per annum for the same period.—*Financial Times.*

Reduction of Capital.—THE OTIS ELEVATOR CO., LTD., REDUCED.—A petition for the confirmation of the reduction of capital from £200,000 to £68,190 has been presented, and will be heard on January 27th.

Harper Electric Piano (1910) Co., Ltd.—A dividend at the rate of 2½ per cent. per annum for the half-year ended December 1st last is announced.

Electric Construction Co., Ltd. — According to a financial daily the directors have declared an interim dividend at the rate of 7 per cent. per annum on the preference shares for the half-year to November 30th.

STOCKS AND SHARES.

Tuesday Evening.

STOCK EXCHANGE markets have suddenly developed most unlooked-for strength in all the investment departments. There was such a rise in Consols within two or three days as made men rub their eyes and wonder if they saw the figures correctly. The Bank Rate is expected to be reduced to 4 per cent. before the month is out, general anticipation looking for this to come about on Thursday in the present week. Capital long hoarded up is being poured into the markets at a rate so rapid as to create a partial scarcity of the best classes of securities. Put picturesquely, the position is that, whereas two or three weeks ago it was impossible to sell anything, to-day it is equally impossible to buy—assuming in both cases, of course, that buyer and seller wanted to deal at satisfactory figures.

The cheapening of money, the release of capital, and the remarkable collapse of the South African strike are the three principal factors which have brought about so violent a change in Stock Exchange sentiment. What is more comforting to the House itself is the fact that they have also encouraged a decided increase in the volume of business. Even speculation begins to lift up its timid head ; and people who have not been near the Stock Exchange for many a month past are writing to their brokers—sometimes ostensibly on behalf of friends—to know if it is worth while buying anything by way of a flutter. Tuesday's rumour as to the health of the German Emperor was not credited, but it had an arresting influence on business. Wicked men suggested that the Kaiser was suffering from "son-stroke."

From the price lists published overleaf, it will be noticed that the rises far outnumber the falls. The former are well distributed over the six sections into which our quotations are divided ; and although the Electricity Supply department shows a halting tendency, it must be remembered that not a few of the stocks and shares here have enjoyed respectable rises, what time the rest of the markets were steeped in depression and gloom.

Affairs in Mexico, it seems to be generally admitted, are now about as bad as they can be, and the prevailing impression is that any change must be for the better. A comfortable theory this, but one which is likely, of course, to be rudely disturbed, even by a few drunken revolutionaries. It is, however, inappropriate to suggest such a bearish consideration when the markets at last give indications of getting on their legs once more ; and more useful will it be, perhaps, to direct attention to the returns obtainable from bonds of companies connected with the Latin-Canadian group, as a whole. Substantial gains followed upon the circulation of reports that Huerta had responded to United States pressure, and had resigned.

So far as Mexico is concerned, it is tolerably certain that, when affairs settle down, a good deal of extra money will be required to reconstruct the business relations that prevailed previously, and such a consideration suggests the likelihood of prior lien bonds or short-term notes being placed in front of existing securities. Nevertheless, if market conditions keep as strong as they are at present, tempting new issues will certainly find ready homes, and money will be obtainable on terms a great deal less onerous than would have seemed possible, say, a month or so ago.

The Home Railway market is good, with noticeable activity in all the steam stocks. Remains, however, the lurking fear as to how dividends may be expected to materialise in respect of the last half of 1913, seeing that the prophets have no reliable data upon which to work. The principal rises, so far as our lists are concerned, are those secured by the Underground Electric Railways issues, four out of the five showing gains, of which the principal is a rise of 2 in the 6 per cent. income bonds, which carried the price to 94. Metropolitans and Districts are both better. Central London assented stocks have been put up; and within the past few days dozens of Home Railway prior charge securities have advanced ½ to 2 points, in which movement the Undergrounds participated—Districts 6 per cent. Debenture, for example, gaining 3 at 137½. London United Tramways Debenture is 4 points higher. On the other hand, London and Suburban Preference eased off a few pence.

In the Electricity Supply group, City "Lights" have recovered the slight fall which took place at the end of last week, and the company's 5 per cent. Debenture stock improved with the rest of the investment markets. Urban Preference rose to 2¾; Westminster Preference regained the dividend of 2s. 3d. and another $\frac{1}{16}$ as well. The rises secured last week in other stocks and shares have been maintained, and, in Stock Exchange parlance, the market really is better than it looks.

British Columbia Electric issues are rapidly wiping out the falls which overtook them on the appearance of the last and rather disappointing report. The Deferred stock has risen 7, the Preferred is 4 up, and the 5 per cent. Preference recovered 1½ of its dividend. Shawinigan Water, *ex* 3 per cent., is 3½ higher, Canadian General Common rose 2, and other Canadian issues are shaking off the effects of the spasm of suspicion which lately fastened on most things connected with the Dominion. Mexican Light and Power Common and Preference are substantially better, but the Company's Bonds remain depressed. As in the case of the Mexico Tramways Company, the Mexican Light and Power announces that dividends on the Common shares will not be paid, in consequence of the disturbed state of the country; but the declaration was sweetened by an assurance that, in spite of this, the undertakings are making good progress, and have not been upset as much as might have been expected by the disorders. Thanks to this, Mexico Tramways Common shares are actually 4 higher, and the Second Bonds are 2 to the good.

Brazilian investments of all kinds are also making progress towards recovery. Southern Electric of Buenos Ayres Debenture stock followed up its last week's rise of 2 with a further gain of 3 points, and Brazilian Traction shares rose 2 to 86. Outside these, Havana bonds are lower, and Cape Electric Trams went back a little. Brisbane Trams, however, have spurted, and the Ordinary shares are 5s. higher, the 4½ per cent. Debenture stock also improving a point. Calcutta Trams Preference shares and the Debenture stock have improved. Buenos Ayres Port and City Tramways 6 per cent. First Debenture stock fell from 86 to 72, business being marked at 70 early this week.

Most of the active Manufacturing shares are on the up-grade. The feature is the activity of British Westinghouse Preference. These £2 shares have further spurted to 26s. 3d., a gain on the week of $\frac{3}{16}$. The 4 per cent. Debenture stock gained 3, the Prior Lien Debenture at 103½ is 2 up. The reason of the buying is ascribed to knowledge of the excellent business which the company has in hand. There is talk of a possible dividend on the Preference shares in the near future—as to which, however, rumour is unable to speak with any certainty. Brush 4½ per cent. Debenture rose to 41, a gain of 2½ points. On the other hand, the Preference are 0 to ¼. There has been a substantial seller of Edison and Swan 4 per cent. Debenture stock in the market, and although the only quotable change is a fall of 1 in the price, it is possible that a bid at the lower level (54) might attract the stock which has been on offer, but which may, of course, have been taken before these lines appear in print. Henleys have risen 10s., Callenders 5s., and both companies' Debenture stocks have gained a point. British Aluminiums have improved, and a moderate demand sufficed to put up the price of Crompton Debenture to 73, a rise of 4½ since last week. Castner-Kellners are unchanged.

Amongst the speculative shares to attract attention have been Marconis, and here the parent shares are 5s. to the good, while the Preference have risen $\frac{3}{16}$. Americans have jumped to 22s. 6d., and Canadians touched 11s., reverting later to 9s. 9d. The rise is attributed to buying orders from the United States, and that there was, at all events, some demand from the other side is certain enough. The investment stocks and shares in the Telegraph and Telephone group have mostly improved with the rest of the markets. Globe Ordinary and Preference are both 5s. higher. On the other hand, Monte Video Telephones are dull, and West India and Panama Telegraphs, after their sharp spurt, reacted 2½. Indo-European Telegraphs are 10s. lower, and Direct United States Cable shares lost ½. The terrible disaster in Japan, while it shook the prices of securities connected with the Government and municipalities, had no particular effect upon the quotations of cable descriptions.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, January 21st.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	3d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£30 10	..
a Bleaching powder	„	£6 5	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	..
a Copper Sulphate	„	£22 10	..
a Lead, Nitrate	„	£29 10	..
a „ White Sugar	„	£28	..
a „ Peroxide	„	£32	..
c Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	£9/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£8 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70/72 %) ..	„	£10 5	..
a „ Chlorate	per lb.	3½d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£90	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£116 13 4	..
b „ Sheet, in ton lots ..	„	£112	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7⅞d.	¼d. dec.
c „ Tube (brazed)	„	9½d.	¼d. dec.
c „ „ (solid drawn)	„	8¾d.	¼d. dec.
c „ Wire, basis	„	7¼d.	¼d. dec.
c Copper Tubes (brazed)	„	10½d.	¼d. dec.
c „ „ (solid drawn) ..	„	10½d.	¼d. dec.
g „ Bars (best selected) ..	per ton	£81	£2 dec.
g „ Sheet	„	£81	£2 dec.
g „ Rod	„	£81	£2 dec.
d „ (Electrolytic) Bars	„	£66 10	£2 dec.
d „ „ Sheets	„	£84 10	£2 dec.
d „ „ Rods	„	£72	£2 dec.
d „ „ H.C. Wire	per lb.	8⅜d.	¼d. dec.
f Ebonite Rod	„	4/6	..
f „ Sheet	„	4/-	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	7/-	..
h India-rubber, Para fine	„	8/1	¼d. dec.
i Iron Pig (Cleveland warrants) ..	per ton	50/8½	7½d. inc.
„ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£20 10	£1 10 inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 10	..
c Mica (in original cases) small ..	per lb.	6d. to 8s.	..
c „ „ „ medium	„	3/6 to 6/-	..
c „ „ „ large ..	„	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	„	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/0⅝ to 1/3	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	¼d. dec.
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£174 to £175	£4 10 inc.
n „ Wire, Nos. 1 to 16	per lb.	2/5	..
p White Anti-friction Metals	per ton	£44 to £194	..
k Zinc, Sh's (Vieille Montagne bnd.)	„	£25 12 6	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—The directors' report for 1913 states (according to the *Financial Times*) that the operations, after providing for all expenses, including repairs, maintenance and debenture interest, resulted in a net income of £27,312, which has been appropriated as follows:—Dividend of 4 per cent. per annum, less income-tax, on the 6 per cent. cumulative preference shares, £8,712; depreciation, renewals, reserve fund in lieu of accident insurance and general reserve fund accounts, £7,090; written off preliminary expenses account, £5,988; carried forward, £5,521. The number of passengers carried during the past year amounted to 10,900,263, and the miles run to 1,787,829, as against 9,787,444 and 1,773,218 respectively for the previous year.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 20th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	3/8 — 1/2 xd	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	12 — 14	..	..
Do. Do. Deferred ..	100	..	..	4½ — 6	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	88 — 91	+1	6 11 10
Do. 7 % Non-Cum. Pr'f.	100	8	..	52 — 55	..	6 9 1
Do. 5 % Perp. Deb. ..	100	5	5	92 — 95	..	5 5 5
Do. 4½ % 2nd Deb. ..	100	4½	4½	76 — 79	−1	5 14 0
Central London Railway, Ord. ..	100	8	8	59 — 64	..	4 13 9
Do. Gtd. Assented ..	100	..	4	83 — 85	+1	4 14 3
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented ..	100	..	4	83 — 85	+1	4 14 3
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented ..	100	..	4	79 — 81	+1	4 18 9
Do. 4 % Deb.	100	4	4	95 — 97 xd	..	4 2 6
City & S. London, 5 % Pref., 1891	100	5	5	96 — 98	..	5 2 0
Do. Do. 1896	100	5	5	96 — 98	..	5 2 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1903	100	5	5	93 — 95	..	5 5 0
Do. 4 % Deb.	100	4	4	88 — 90	−1	4 9 0
Hastings Trams, 6 % Pref. ..	1	6	6†	1/4 — 3/4	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 5 3
Lancashire United, 5 % Deb. ..	100	5	5	77 — 81	..	6 3 5
London and Suburban, Ord. ..	1	..	..	1/4 — 5/16	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	9/16 — 11/16	−1/32	7 5 6
Do. Do. 4½ % 1st Deb. ..	100	4½	4½	72 — 77 xd	..	5 17 0

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 20th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
London Elec. Railways, 4 % Deb.	100	4	4	89 — 91	−1	4 7 11
London United Trams, 4 % Deb.	100	4	4	62 — 66	+4	6 1 3
Metropolitan Railway Consol. ..	100	1⅝	1½†	45⅞ — 46¼	+ ⅛	3 10 3
Do. Surplus Lands	100	2¼	2¼†	58 — 60	..	4 11 8
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	80 — 82	+2	4 5 4
Do. 3½ % Con. Pref.	100	3½	3½	77 — 79	+1	4 8 9
Metropolitan District Ord. ..	100	Nil	..	31⅞ — 32¼	+ ⅜	Nil
Do. 6 % Deb.	100	6	6	186 —189	+3	4 6 4
Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Do. 4 % Prior Lien	100	4	4	94 — 96	..	4 3 4
Do. 4½ % First Pref.	100	4½	4½	81 — 83	..	5 8 5
Do. 3½ % Gtd.	100	3½	3½	75 — 77	+1	4 11 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	80 — 84 xd	..	5 7 2
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3½	..	3/16 — 5/16	..	..
Do. 5 % Pref.	1	5	5	3/16 — 5/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	7/8 — 1	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways ..	10	..	..	8⅜ — 8⅝	+ ⅛	Nil
Do. "A"	1/-	..	..	7/16 — 1/2	+ 1/32	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	113 —115	+1	5 4 2
Do. 4½ % Bonds	100	4½	4½	98 —100	..	4 10 0
Do. 6 % Income	100	6	6	93½ — 94½	+2	6 7 0
Yorkshire (West Reading), Ord. ..	5	Nil	..	1/16 — 3/16	+ 1/16	Nil
Do. 6 % Pref.	5	3	4	3¾ — 4	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	79 — 84	..	5 7 2

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4⅜ — 5	..	5 10 0
Do. 2nd Pref.	5	5½	5½	4 3/16 — 4 7/16	..	6 3 11
Do. 4 % Deb.	100	4	4	89 — 91	..	4 8 0
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do 5 % Deb.	100	5	5	97⅝ — 99½	..	5 0 6
Auckland Trams, 5 % Deb. ..	100	5	5	102 —105	+2	4 15 3
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11⅛	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	92 — 94	..	4 15 9
Do. 5 % 2nd Deb.	100	5	5	95 — 98	..	5 2 0
Brazilian Traction, Light and Power	$100	6	6†	85 — 87	+2	6 17 11
Brisbane Trams Invt., Ord. ..	5	8	8	7⅜ — 8⅛	+ 1/4	4 18 6
Do. 5 % Pref.	5	5	5	4⅛ — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	97 —100	+1	4 10 0
B Columbia Elec. Rly., Def. ..	100	8	8†	106 —110	+7	7 5 6
Do. Pref. Ord.	100	6	6	103 —107	+4	5 12 2
Do. 5 % Pref.	100	5	5	99 —103 xd	+1	4 17 0
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	94 — 98 xd	..	4 12 0
Do. 4½ % Con. Deb.	100	4½	4½	91 — 94	..	4 10 5
Calcutta Trams, Ord.	5	7⅛	5†	6 — 6⅛	..	5 15 5
Do. 5 % Pref.	5	5	5	4 15/16 — 5 1/16	+ 1/16	4 16 7
Do. 4½ % Deb.	100	4½	4½	96 — 99	+1	4 11 0
Cape Electric Trams	1	5	5	1/2 — 33/64	−1/32	6 19 0
City Buenos Aires Trams (1904)	5	5†	5	5½ — 5⅝	..	4 10 11
Do. 4 % Deb.	100	4	4	91 — 96	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Havana Elec. Rly., 5 % Bonds ..	$1000	5	5	93½ — 97⅞ xd	..	5 2 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	Nil
Do. 5% A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6% B Deb.	100	3	..	10 — 20	..	Nil

La Plata Elec. Trams, Ord. ..	1	..	..	3/8 — 1/2	..	..
Do. Pref.	1	4½d.	6	1/2 — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	8	6†	1⅛ — 1⅜	..	4 7 3
Do. 6 % Pref.	1	6	6	1 1/16 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4½ — 5½	..	5 14 3
,, Elec. Tr. (1904), Deb. ..	100	5	5	99 —101	..	4 19 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	79 — 82	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96½ — 98½	..	5 1 6
Mexico Trams Com	$100	7	7	67 — 71	+4	..
Do. Gen. Con. 5 % Bonds ..	..	5	5	73½ — 77½	−1	6 9 0
Do. 6 % Bonds	100	6	6	75 — 79	+2	7 11 11
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	5 — 5½	..	9 1 10
Do. 6 % Pref.	5	6	6	4½ — 4⅝	..	6 9 9
Do. 5 % 1st Deb.	100	6	5	93½ — 95½	..	5 4 6
Perth (W.A.) Elec. Tr., Ord., ..	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Rio de Janeiro Trams, 1st Mort. & 5 % Bonds	..	5	5	97½ — 99½	+ ⅜	5 0 6
Do. 5 % Mort. Bonds	100	5	5	89 — 91	..	5 10 0
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	96 — 99	..	5 1 0
Singapore Trams, 5 % Deb. ..	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	98 —100	+3	5 0 0
Un. Elec. Trams Monte Video ..	5	7	7	4⅜ — 4⅝	..	7 3 7
Do. 6 % Pref.	5	6	6	4⅜ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	93½ — 96½	..	5 3 8
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord. ..	10	6	5†	9 — 10	..	4 14 9
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	6 0 0
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96	..	4 13 9
Brompton & Kensington, Ord. ..	5	10	9†	8¾ — 9¼	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	90 — 93	..	4 6 0
Charing Cross, West End & City	5	5	5†	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3½ — 4	..	5 12 6
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 8 0
Chelsea, Ord.	5	5	4†	4⅜ — 6⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	95 — 98	..	4 11 9
City of London, Ord.	10	9	6†	16½ — 17½	..	5 2 10
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	115 —119	+1	4 4 0
Do. 4½ % Second Deb. ..	100	4½	4½	97½ — 99½	..	4 10 6
County of London, Ord.	10	6	5†	11⅜ — 12⅛	..	4 18 0
Do. 6 % Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	101 —103	..	4 7 5
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 — 101	..	4 9 1
Edmundson's, Ord.	£3	..	..	1/16 — 3/16	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅜ — 4½	..	7 5 5
Do. 6 % Non-Cum. Pref. ..	5	..	..	1⅜ — 1⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 83 xd	+1	5 8 5
Folkestone	5	6	6	4⅜ — 4⅝	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅝	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	87 — 89 xd	..	5 1 2

Hove	5	8	8†	8⅜ — 9⅛	..	4 17 3
Kensington & Knightsbridge, Ord.	5	8	8†	7⅞ — 8⅛	— ⅛	4 19 8
Do 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	74 — 78 xd	..	5 15 6
London Electric, Ord.	3	2½	..	1⅛ — 1⅜	..	4 12 7
Do. 6 % Pref.	5	6	6	4⅝ — 5⅛	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 3
Metropolitan	5	4	4†	3⅜ — 3⅞	..	5 3 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 14 9
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	96 — 99	..	4 10 10
Do. 3½ % Mort Deb.	Stock	3½	3½	80 — 83	+1	4 6 5
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 —103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅜ — 10⅛	..	5 14 3
Oxford	5	7	6†	6 — 6½	..	5 7 8
St. James' and Pall Mall, Ord. ..	5	10	10†	8½ — 9	..	5 11 1
Do. 7 % Pref	5	7	7	6⅞ — 7⅛	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	82 — 85	..	4 2 4
South London, Ord.	4	5½	..	2⅞ — 3⅛	..	6 15 4
Do. 5 % First Mort. Deb. ..	100	5	5	97 — 100	..	5 0 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 3/16 — 1 5/16	..	5 14 9
Do. 4½ % First Deb. Stock ..	100	4½	4½	93 — 96	..	4 13 9
Urban, Ord.	£3	Nil	..	1/16 — 3/16	..	..
Do. 5 % Cum Pref.	5	3‡	..	2⅜ — 3	+ ⅛	5 0 0
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Westminster, Ord.	5	10	10†	8½ — 9	+ ¼	5 11 1
Do. 4½ % Cum Pref.	5	4½	4½	5 — 5¼ xd	+ 1/16	4 5 10

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ 3s. Cash and 2% in Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 20th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	£ 5	6	6†	5¼ — 5⅝	..	£ s. d. 5 11 7
Calcutta, Ord.	5	8½	8†	7⅞ — 7⅞	..	5 8 0
Do. 5 % Pref.	5	5	5	4 15/16 — 5 1/16	+1/16	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	88½ — 90½	..	5 9 3
Canadian Gen. El. Com.	$ 00	7	8	104 —109	+2	7 6 10
Do. 7 % Pref.	$100	7	7	119 —124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	5	..	15/16 — 1 1/16	..	7 12 0
Do. 5 % Deb.	100	5	5	91 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	88 — 90	..	6 13 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93½ — 95½	..	5 4 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 3/16	..	Nil
Do. 6 % Pref.	£ 1	6	6†	5/8 — 11/16	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	100⅜ —102⅜	..	4 17 6
Madras, Ord.	£ 5	Nil	..	1⅛ — 1⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101 —104	..	4 16 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	64 — 68	+2	7 7 1
Mexican Lt. & Power, Common	$100	4	4†	41 — 44	+2	..
Do. 7 % Cum. Pref.	$100	7	7	72 — 76	+3	9 4 2
Do. 5 % 1st Mort. Gold Bds.	..	5	5	73 — 77	..	6 9 10
Do. 5 % 2nd Mort. Bonds	100	5	5	58 — 62	..	8 1 4
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	£ 100	1919. 5	1918. 5	51 — 56	+1	£ s. d. 8 19 6
Montreal, Lt., H. and Power	$100	9	10†	219 —225	..	4 9 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	101 —106	..	5 13 2
Do. 5 % Deb. Stock	Do.	5	5	93 —100	..	5 0 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	£ 100	4½	4½	99 —101	..	4 9 4
Shawinigan Water, Capital	$100	6½	6†	136 —141	+3½	4 5 1
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	103½—105½ xd	..	4 14 9
Do. 4½ % Per. Deb.	Stock	4½	4½	96 — 98	— ½	4 11 10
Toronto Power, 4½ % Deb.	Do.	4½	4½	95 — 98	..	4 11 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	£ 100	5	5	87 — 89	..	5 12 4
Victoria Falls Power, Pref.	£ 1	6	6	25/8 — 27/8 xd	+1/16	7 2 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	£ 100	6	6	108 —105	..	5 14 8

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 20th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	£ 1	7	..	3/8 — 13/16	..	£ s. d. 8 12 4
Do. 6 % 1st.	1	6	6	3/16 — 3/8	..	8 0 0
Babcock & Wilcox	1	16	14†	21⅜ — 8 1/16	..	5 4 6
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	4 3 6
British Aluminium, Ord.	1	..	..	1 3/16 — 1 5/16	+1/16	..
Do. 6 % Cum. Pref.	1	6	6	5/8 — 11/16	..	6 13 6
Do. 5 % Prior Liens Debs.	100	5	5	98 — 96	+1	5 4 0
Do. Deb. Stk.	100	5	5	86 — 89	+1½	5 12 4
B.I. & Helsby Cables	£ 5	10	8†	8¼ — 9½	..	5 8 1
Do. Pref.	5	6	6	5½ — 6½	..	4 16 0
Do. Deb.	100	4½	4½	99 —102	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref.	£ 2	Nil	..	1⅛ — 1⅜	+1/16	Nil
Do. Deb.	100	4	4	67 — 70	+3	5 14 4
Do. 6 % Prior Lien	100	6	6	102 —105	+2	5 14 6
Browett, Lindley, Ord.	£ 1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	£ 2	Nil	..	0 — ¼	— ⅛	Nil
Do. 5 % Prior Lien Deb.	100	5	5	75 — 80	..	6 5 0
Do. 5 % Deb.	100	4½	4½	39 — 43	+2½	10 9 4
Do. 4 % Second Deb.	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	£ 5	15	5†	10⅜ — 11¼	+ ⅛	6 10 4
Do. Pref.	5	5	5	4 13/16 — 5 1/16	..	4 18 9
Do. Deb.	100	4½	4½	96 — 99	+1	4 11 0
Castner-Kellner	£ 1	20	22½	21½ — 23½	..	..
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Crompton & Co., Deb.	£ 100	5	5	71 — 75	+4½	6 18 4
Dick, Kerr	£ 1	Nil	..	5/16 — 7/16	..	..
Do. Pref.	1	6	6	13/16 — 15/16	..	7 9 2
Edison & Swan, A, £2 paid	£ 5	Nil	..	0 — 1/16	..	Nil
Do. fully paid	£ 5	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	54 — 58	—1	6 17 11
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	£ 1	5	..	3/16 — 5/16	..	7 5 6
Do. Pref.	1	7	7	1 1/16 — 1 1/8	..	6 11 9
Greenwood & Batley, Pref.	£ 10	7	7	6¾ — 7½	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	£ 10	6	6	9⅝ — 10⅜	..	5 18 5
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	£ 5	15	10†	13½ — 14	+ ⅛	5 7 1
Do. Pref.	5	4½	4½	4 3/16 — 4 7/16	— ⅛	4 12 4
Do. Deb.	100	4½	4½	100 —102	+1	4 8 3
India-Rubber, G. & T.	£ 10	7½	7½	11 — 12	..	6 5 0
Do. Pref.	10	5	5	9 — 9⅝	..	5 2 7
Telegraph Construction	£ 12	20	5†	37 — 39	..	6 8 1
Do. Deb.	100	4	4	96 — 98	..	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	£ 100	4	4	65 — 69	..	5 16 0
Do. B 4 % Cum. Pref.	£ 100	..	..	51 — 56	..	..

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 20th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	£ 10	4½	4½	6¼ — 6⅝	..	£ s. d. 6 13 4
Do. 5 % Deb. Red.	Stock	5	5	98 — 96	..	5 4 0
American Telep. & Teleg., Cap.	$100	8	8	125 —128	+1	6 5 0
Do. Collat. Trust	$1000	4	4	88 — 91	+1	4 8 0
Anglo-American Telegraph	Stock	3	3	62 — 65 xd	..	4 12 4
Do. 6 % Pref.	Do.	6	6	103⅜—104⅜ xd	..	5 14 2
Do. Def.	Do.	80/-	..	23⅛— 25⅜	+ ⅜	6 7 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	£ 100	5	5	102 —104	..	4 16 2
Chili Telephone	£ 5	8	..	7½ — 7⅝ xd	+1/16	5 6 8
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	78 — 80	+ ½	5 0 0
Cuba Telegraph	£ 10	6	6†	8 — 9	..	6 13 4
Do. 10 % Pref.	£ 10	10	10	14⅜ — 15⅜	..	6 9 0
Direct Spanish Telegraph, Ord.	£ 5	4	4	8⅜ — 8⅝	..	5 6 8
Do. 10 % Cum. Pref.	£ 5	10	..	6⅞ — 7⅛	..	6 12 0
Direct United States Cable	£ 10	4	4†	6⅛ — 6⅜	..	5 18 6
Direct W. India Cable, 4½ % Reg. Deb.	£ 100	4½	4½	96 —98 xd	..	4 11 10
Eastern Telegraph, Ord. Stock	Stock	7	7	125 —128 xd	+1	5 9 8
Do. 8½ % Pref. Stock	Do.	8½	8½	74½ — 76½ xd	..	4 11 4
Do. 4 % Mort. Deb.	Do.	4	4	94 — 96	..	4 3 4
Eastern Extension	£ 10	7	7	12 — 12⅝ xd	+ ⅛	5 12 0
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust	£ 10	6	6†	11 — 11⅝	+ ⅛	5 4 4
Do. 6 % Pref.	£ 10	6	6	12 — 12⅝	+ ⅛	4 16 0
Great Northern Telegraph	£ 10	20	5†	31 — 33	..	6 1 2
Indo-European Telegraph	£ 25	13	5†	56⅜ — 58⅜	— ⅜	5 11 2
Mackay Companies Common	$100	5	5	77 — 81	..	6 3 5
Do. 4 % Cum. Pref.	$100	4	4	66 — 70	..	5 14 4
Marconi's Wireless Telegraph	£ 1	20	20	3⅛ — 3⅜	+ ⅛	5 10 6
Do. 7 % Cum. Partic. Pref.	£ 1	17	..	2⅞ — 3	+1/16	5 13 4
Monte Video Telephone, Ord.	£ 1	6	6	7/16 — 9/16	— ⅛	6 17 2
Do. 5 % Pref.	£ 1	5	5	7/16 — 9/16	..	6 13 4
New York Telep., 4½ % Gen. Bnds.	£ 100	4½	4½	99 —100	+ ⅜	4 10 0
Oriental Telep. and Elec.	£ 1	10	10†	1¾ — 2	..	5 0 0
Do. 6 % Cum. Pref.	£ 1	6	6	1 1/16 — 1 1/8	..	5 1 1
Do. 4 % Red. Deb.	Stock	4	4	86⅛ — 88⅛	+ ⅛	4 10 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96 — 98	..	4 1 8
Reuter's	£ 10	10	10†	8⅞ — 9⅜	..	10 5 2
Submarine Cables Trust	Cert.	6	6	122½ —125½	..	4 15 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95½ — 97½	+ ⅛	4 12 4
United River Plate Telephone	£ 5	8	6†	6⅛ — 6⅜	— ⅛	5 18 5
Do. 5 % Cum. Pref.	£ 5	5	5	4⅞ — 5⅛	..	4 13 0
West Coast of America	£ 2½	2½	..	1 1/16 — 1 1/8	..	4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	£ 100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	£ 10	1½	1½	2⅜ — 2⅝	+1/16	4 15 3
Do. 6 % Cum. 1st Pref.	£ 10	6	6	9¾ — 10¼	..	5 17 0
Do. 6 % Cum. 2nd Pref.	£ 10	6	6	9 — 9½	..	6 6 4
Do. 5 % Debs.	£ 100	5	5	96 — 98	..	5 2 0
Western Telegraph, Ltd.	£ 10	7†	7	12⅜ — 13⅛	..	5 6 8
Do. 4 % Debs.	Stock	4	4	91 — 93	+1	4 6 0
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	92 — 95	..	4 14 9

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 4½ per cent., January 8th, 1914.

A Great Russian Enterprise.—The St. Petersburg Electric Lighting Co. of 1886, in which German capital is largely interested, has now become the largest supply undertaking in Russia, although its scope of activity is not limited to the capital. Formed in 1886 and keeping that year as part of its title, the company has gradually raised its capital to £3,100,000 in ordinary shares and £900,000 in preference shares, and a further issue of £1,000,000 in ordinary shares is now being made, which will increase the total to £5,000,000. The proceeds of the present issue, which has been offered in Germany at the price of 107 per cent. or 110 per cent., including the stamp tax, are to be devoted to the extinction of the bank debt, which amounted to £800,000 at the date of the last annual report, and to the development of existing interests in Sosnowice, Bogorodzk, and the suburbs of St. Petersburg. Having already furnished a supply in certain localities outside St. Petersburg, the company in 1912 obtained a concession for supply in other outside districts, but owing to the difference between the concessions it was deemed essential to form the St. Petersburg Electric Power Transmission Co. to deal with these areas, and to take over the parent company's system for serving them. It is intended to provide a separate power station for the transmission company in the course of time. The station at Bogorodzk, which is to have an initial capacity of 25,000 H.P., is in course of construction and equipment for the supply of that district and also for transmission to Moscow, where the electrical energy will serve as an addition to the output of the St. Petersburg company's station in Moscow. In the case of Sosnowice the parent company has a local supply company which has a capital of £400,000, and which finds a sphere of activity in that industrial district and the adjoining one of Dombrova. The dividend paid by the St. Petersburg company was 8 per cent. on the ordinary capital in 1912, as against 7½ per cent. in 1911.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING DECEMBER, 1913.

THE December returns of electrical export and import business, which bring to a conclusion a record year's trade, suffer as regards the exports by comparison with the previous month's huge total, the bulk of which represented telegraphic material. Thus, the December exports were valued at £519,549 as compared with £1,135,400 in November; excluding telegraphic exports, however, the totals were £397,848 and £465,778 respectively, showing a decline in general business for the month, but still a not unsatisfactory total.

The imports for the month amounted to £294,844—the highest total for any month during 1913—which compares with £258,937 in November; the re-exports also reached a high level, £32,347 being some £5,000 in advance of the previous month's total.

Almost without exception the various sections of the exports show decreases, including, of course, the heavy deficit in telegraphic exports, some £20,000 in cables and £16,000 in machinery exports; while as regards the imports, machinery and telegraphic and telephonic imports, among others, show a considerable advance on the previous month.

Of the various purchasing centres, Aden, credited with £64,000 worth of telegraphic cable, achieves fleeting notoriety, but amongst our more stable customers with whom satisfactory business resulted, were India, Victoria, Japan, Argentina, &c.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	2,282	816	226	143	3,462	356	3,572	185	293	365	52	1,605	13,357
Germany	2,487	2,549	20	66	456	6	3,014	...	12	578	82	29	9,299
Netherlands, Java and Dutch Indies ...	529	2,496	174	42	39	...	914	...	154	68	...	414	4,830
Belgium	307	431	95	11	327	129	3,585	5	25	54	1,007	105	6,081
France	439	13	5,464	32	83	...	872	346	...	...	106	10	7,365
Portugal	79	82	51	20	8	...	943	48	...	9	814	581	2,685
Spain, Canary Isles and Spanish N. Africa...	61	523	234	8	42	185	3,324	120	77	...	1,133	321	6,028
Switzerland, Italy and Austria-Hungary ...	292	26	327	25	182	10	9,101	...	3	312	38	9	10,325
Greece, Roumania and Turkey	244	140	78	28	18	...	98	27	252	3	5,669	453	7,010
Channel Isles, Gibraltar, Malta and Cyprus...	22	32	125	96	6	13	207	...	...	...	13	10,951	11,465
U.S.A., Philippines and Cuba	805	139	65	346	...	144	2,500	...	206	7	33	405	4,650
Canada and Newfoundland	1,890	1,500	633	723	15	2,696	7,603	...	295	66	...	4,948	20,369
British West Indies and British Guiana ...	125	6	89	98	18	...	15	...	14	11	85	50	511
Mexico and Central America	36	463	...	23	...	...	589	417	10	5	31	95	1,669
Peru and Uruguay	159	14	112	26	...	76	2,511	63	3	...	37	22	3,023
Chile	589	1,113	153	156	14	43	2,243	...	110	9	34	8,305	12,769
Brazil	2,253	1,295	1,267	402	7	14	12,084	2,223	35	19	276	2,541	22,416
Argentina	2,428	2,242	1,027	1,587	435	601	13,195	241	1,139	15	5,182	4,392	32,484
Colombia, Venezuela, Ecuador and Bolivia...	8	107	46	441	12	21	1,441	...	23	2	215	19	2,335
Egypt, Tunis and Morocco	253	1,160	148	147	73	68	769	68	211	14	277	840	4,028
British West Africa	74	46	2	100	9	7	2,103	29	128	27	170	850	3,545
Rhodesia, O.R.C. and Transvaal	1,181	98	325	728	59	7	4,484	3	199	...	3	...	7,087
Cape of Good Hope	1,434	5,433	289	124	3	380	4,819	389	702	51	2,746	1,745	18,115
Natal	1,064	4,103	132	335	107	405	905	...	229	...	...	1,400	8,680
Zanzibar, Brit. E. Africa, Mauritius & Aden	265	88	59	307	...	27	1,837	...	15	7	167	65,647	68,419
Azores, Madeira and Portuguese Africa ...	838	463	111	155	12	3	7,139	...	29	...	360	398	9,508
French African Colonies and Madagascar ...	8	14	2	31	...	...	27	...	...	6	4	49	141
China and Siam	520	1,458	286	128	19	172	916	65	92	10	184	5	3,855
Japan and Korea	1,479	914	670	7	...	390	22,949	3,290	137	35	4,806	6,760	41,437
India	4,429	14,352	1,881	2,780	262	903	25 022	2,487	2,746	228	1,692	2,031	58,813
Ceylon	323	415	6	18	7	47	398	...	590	12	472	261	2,549
Straits Settlements, Fed. Malay States, and Sarawak	799	581	206	39	19	93	1,526	488	31	18	121	412	4,333
Hong Kong	612	291	313	91	...	499	327	...	33	27	...	269	2,462
West Australia	442	630	68	417	431	383	449	40	66	53	4,314	...	7,293
South Australia	558	2,847	252	322	36	558	285	...	509	...	859	2,937	9,163
Victoria	2,935	10,738	1,421	1,066	194	2,720	12.576	618	728	3	8,397	351	41,747
New South Wales	1,986	4,523	625	1,554	179	428	9,841	558	570	93	1,551	2,646	24,554
Queensland	67	1,134	467	126	17	13	2,246	...	138	...	405	...	4,613
Tasmania	18	5	75	...	...	35	...	...	185	...	...	...	318
New Zealand and Fiji Islands	1,511	1,502	313	460	213	497	6,351	240	253	15	8,568	345	20,268
Total, £	35,831	64,782	17,837	13,208	6,764	11,929	172,780	11,950	10,242	2,122	49,903	122,201	519,549

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	172	25	5	...	...	105	16,127	...	1,051	...	9,671	27,156
Germany	5,918	27,237	1,637	18,239	10,856	3,735	50,338	375	8,763	11,227	8,533	146,858
Holland	...	...	...	2,244	381	...	...	...	...	174	...	2,799
Belgium	1,431	4,962	16	417	48	1,387	13,085	28	211	619	4,764	26,968
France	41	176	586	2,679	196	1,389	774	222	1,300	3,843	1,651	12,857
Switzerland	185	728	...	14	8	602	7,980	10	26	113	20	9,686
Italy	259	6,390	...	...	39	...	37	...	...	...	290	7,015
Austria-Hungary	22	930	...	323	...	...	60	...	261	322	38	1.956
United States	7,704	261	2,743	325	265	84	13,694	29,887	174	103	3,193	58,433
Total, £	15,732	40,709	4,987	24,241	11,793	7,302	102,095	30,522	11,786	16,401	28,160	293,728

Additional imports: Spain, electrical goods, £30, machinery, £90, carbons, £446; Canada, electrical goods, £530, machinery, £20.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	13,233	891	...	2,966	515	...	12,307	...	292	1,487	656	32,347

TOTAL EXPORTS: £519,549 TOTAL RE-EXPORTS: £32,347. TOTAL IMPORTS: £294,844.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

ELECTRICAL EXPORTS AND IMPORTS DURING 1913 AND PREVIOUS YEARS.

For some years past it has been our custom in January to place before our readers a graphic summary of the progress of British electrical export and import business during the year just closed and preceding years. From this year's curves, of which the first series is shown in fig. 1, it will be seen that the exports (heavy curve) are still mounting upwards, but the general business *excluding telegraphic exports*, indicated by the dot and dash curve, while obviously at a higher average level than in 1912, shows a tendency to fall away.

Actually the approximate gross values of the exports and the values of telegraphic material included therein, during the five years with which we deal graphically, were as follows :—

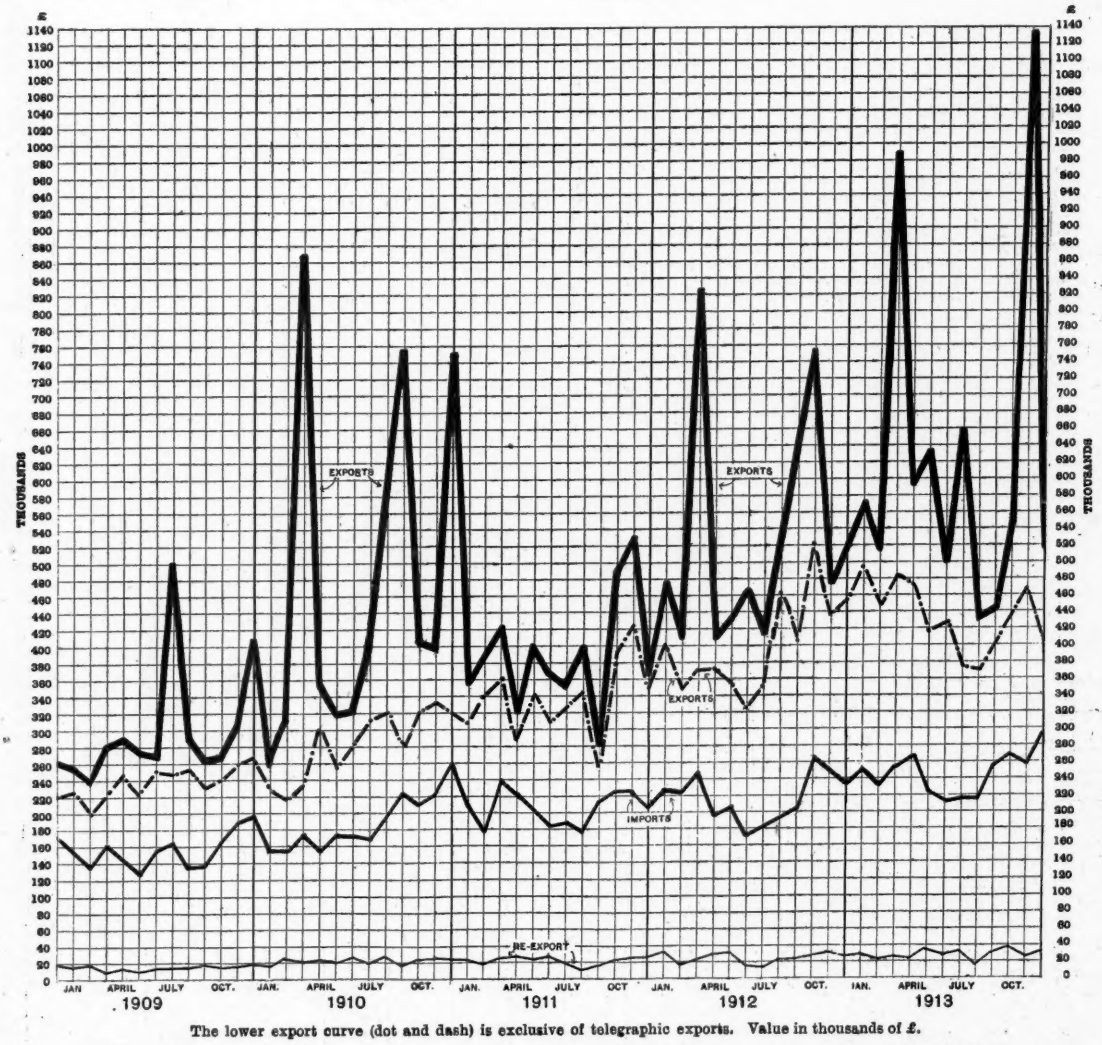
1909,	Gross,	£3,650,000	Teleg.	£805,000
1910	,,	£5,700,000	,,	£2,267,500
1911	,,	£4,600,000	,,	£560,000
1912	,,	£6,300,000	,,	£1,500,000
1913	,,	£7,568,200	,,	£2,388,000

best that can be said of it in 1913 is that it shows no marked downward movement, while actually representing higher values than in 1912.

The curve for cable exports, on the other hand, shows a continuous falling off in business during the year.

The value of electrical machinery exported reached a total of over £2,209,000, being a monthly average of £184,000; cable valued at £968,000—exclusive, of course, of telegraphic and telephonic cable—was exported during the same period, or a monthly average of over £80,000. Together with telegraphic material, machinery and cables are the most important features of our overseas electrical business, and may be compared with advantage with the leading imports into this country, curves for which are shown in fig. 3. These curves show no marked upward or downward tendency during the year in the three sections dealt with, viz., electrical machinery, telegraphic and telephonic material, and lamps and parts, although machinery imports were on a higher level, and the two latter sections at a much lower level than in the preceding year.

Lamp manufacturing has, of course, been largely taken up in this country, and it may be of interest to record that our own exports of lamps and parts were valued at £216,000 for the year, as compared with total imports of the same commodities valued at £313,000.



The lower export curve (dot and dash) is exclusive of telegraphic exports. Value in thousands of £.

Fig. 1.— Chart showing Monthly Electrical Exports and Imports during the past five Years.

The gross values have fluctuated considerably, yet, if we exclude the varying telegraphic exports, the general export business during the five years has steadily improved, as shown by the monthly averages during the period which were :—1909, £236,000; 1910, £286,000; 1911, £336 500; 1912, £400,000; and 1913, £432 000. At the same time telegraphic business reached a higher level in 1913 than during previous years.

Turning to the imports curve, it will be seen that the tendency is upwards, particularly in recent months, and this is also true of the re-exports.

The total value of electrical imports for the 12 months of 1913 shown by our published statistics, was £2,946,000, or a monthly average of £245,000, as compared with £217,000 in 1912; the electrical re-exports for the year were valued at over £341,000—a monthly average of about £28,000.

Fig. 2 shows separately the curves of electrical machinery and cable exports for five years; our overseas trade in electrical machinery has been steadily progressive for some years, but the

Electrical machinery imports totalled £1,300,000, and telegraphic and telephonic imports £314,000 approximately, during the 12 months.

Purchasing Countries and Importers into the United Kingdom.

Figs. 4, 5 and 6, which show graphically three years' business with some of our principal customers, will be viewed with mixed feelings, indicating, as they do on the whole, an unfavourable tendency during 1913.

Thus in fig. 4, the curves of business with Canada, Brazil and Argentina show a decided falling off during 1913, although the year started excellently, and the monthly average was probably as good as that obtaining in 1912.

The curious kink in the Argentinean curve may be noted, when the official returns, rightly or wrongly, showed a month's business amounting to only a few hundreds of pounds. Canada, and indeed other countries, have suffered from a monetary stringency, but Brazil has never been a very stable customer.

The curves given in fig. 5 relate to Australasian and South African exports; in both cases the year started well, but the downward tendency can be seen at the close of the year. On the average, however, business during 1913 compared quite favourably with that during 1912.

Germany, pre-eminent in this direction in the past, it will be seen, shows no tendency to increase her electrical business with us, the trend being generally towards a slight falling off, if anything.

The United States, however, which has for some years main-

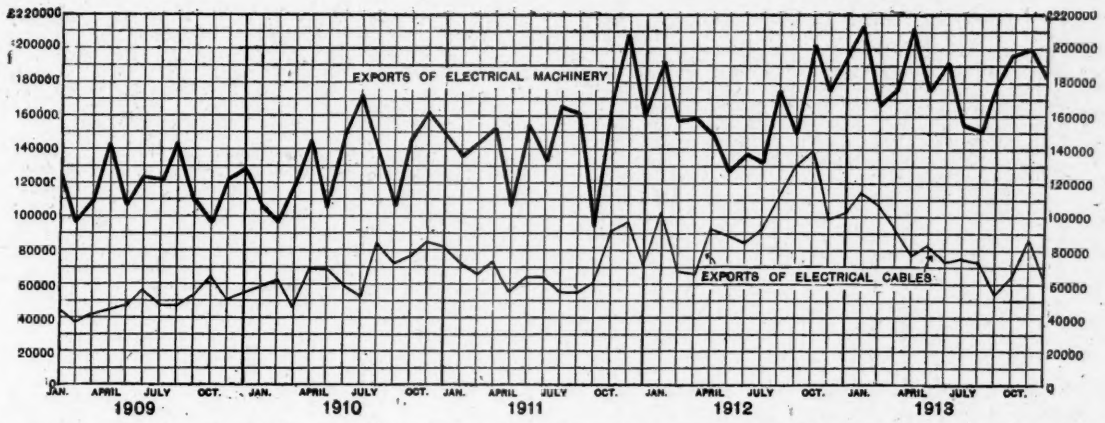


FIG. 2.—MONTHLY EXPORTS OF ELECTRICAL MACHINERY AND ELECTRICAL CABLE—OTHER THAN TELEGRAPHIC OR TELEPHONIC CABLE—DURING THE PAST FIVE YEARS.

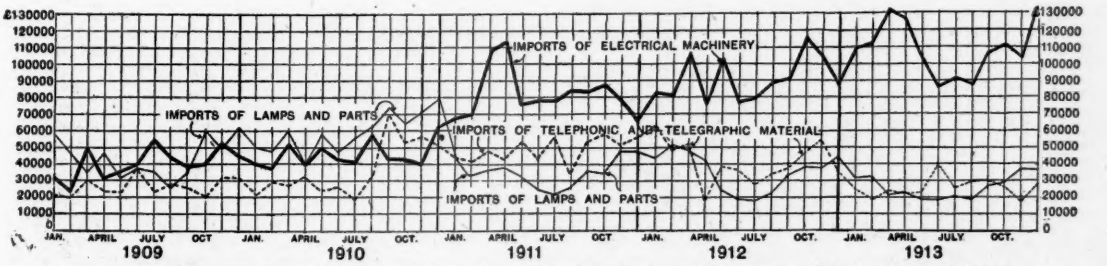


FIG. 3.—MONTHLY IMPORTS OF ELECTRICAL MACHINERY, TELEGRAPHIC AND TELEPHONIC MATERIAL AND CABLE, AND ELECTRIC LAMPS AND PARTS, DURING THE PAST FIVE YEARS.

Turning to fig. 6, which deals with our business in the Far East, the curve for Indian trade is a welcome contrast to those previously referred to, as it indicates not only a great increase in exports as compared with 1912, but also a decided upward tendency during 1913, in continuation of that shown in the previous years. On the other hand, our Japanese business fell away during the year to quite small dimensions, as compared with 1912, recovering to some extent towards the end; Chinese trade, which has been somewhat lifeless during recent years, is apparently becoming brisker, the December total being particularly encouraging.

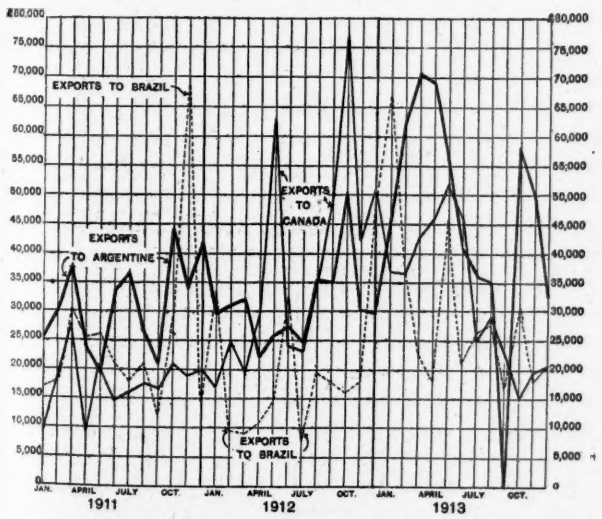


FIG. 4.—ELECTRICAL EXPORTS TO CANADA, ARGENTINA AND BRAZIL, 1911-13.

The gross value of electrical business with the countries mentioned was approximately as follows during the year:—India, £1,769,000; Australia and New Zealand, £1,283,000: Argentina, £558,000; South Africa, £508,000; Canada, £392,000; Brazil, £350,000; Japan, £309,000; and China, £159,000.

Our last set of curves, fig. 7, dealing with the most prominent foreign importers into this country, will be viewed with interest.

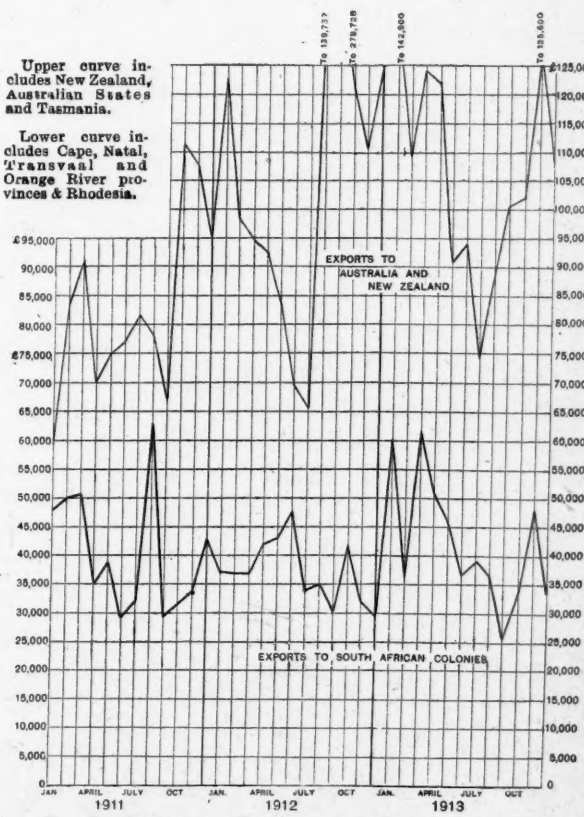

Upper curve includes New Zealand, Australian States and Tasmania.
Lower curve includes Cape, Natal, Transvaal and Orange River provinces & Rhodesia.
EXPORTS TO AUSTRALIA AND NEW ZEALAND
EXPORTS TO SOUTH AFRICAN COLONIES
1911
1912
1913

FIG. 5.—ELECTRICAL EXPORTS TO AUSTRALASIA AND S. AFRICA, 1911-13.

tained a steady electrical business with us, has during 1913 more than doubled its electrical trade with this country, the upward

tendency being most marked; to a less extent this may also be said of the Belgian import trade, while French importers are also waking up. It is probable, therefore, that the increased value of

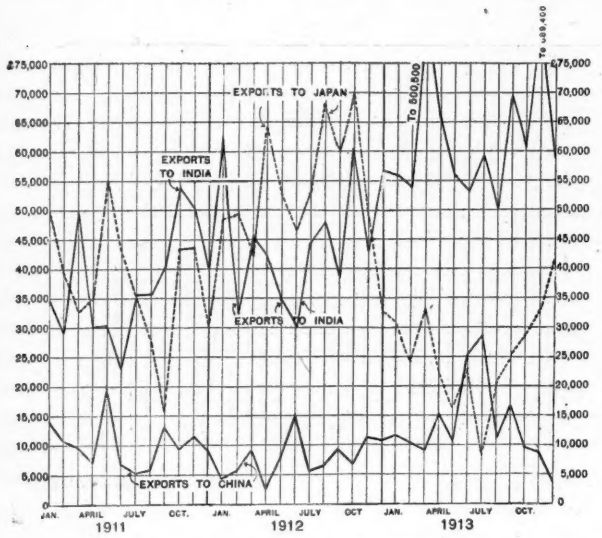


Fig. 6.—Electrical Exports to Japan, India, and China, 1911-13.

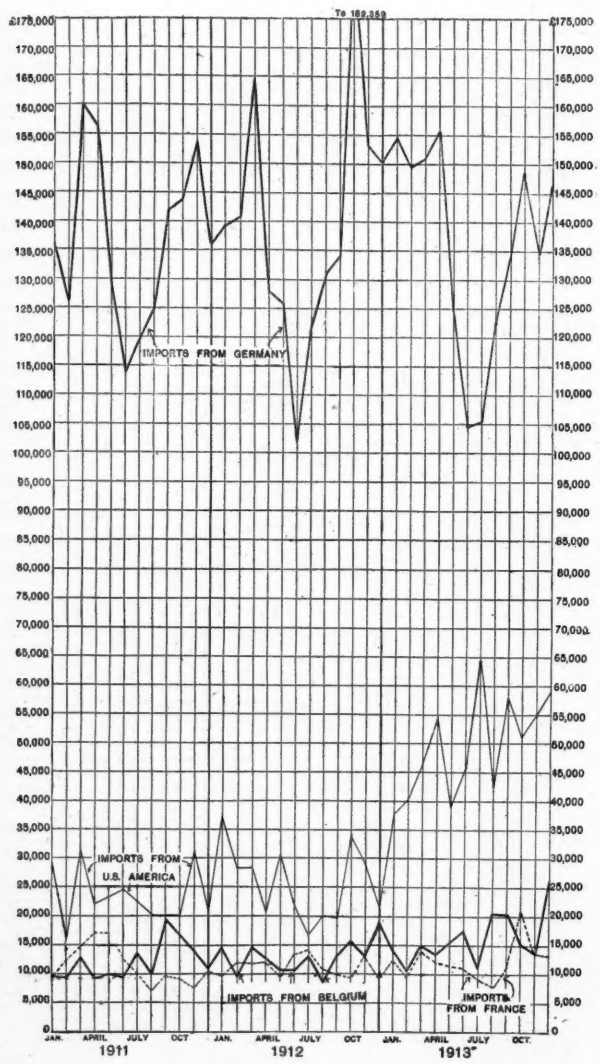


Fig. 7.—Electrical Imports from Germany, U.S.A., Belgium, and France, 1911-13.

the imports for 1913 was due rather to our American and Belgian rivals than to Germany.

General.

Judged by the value of business done, the year 1913 was a record one for the British exporter.

Gratification at this result may, however, be tempered somewhat by the knowledge that very flourishing telegraphic exports have to some extent obscured the fact that the progress in other directions, such as machinery and cable exports, has been on a smaller scale than in previous years.

This slackening off in general business, averaged throughout 1913, was roughly equivalent to a drop of £32,000 a month, as compared with the improvement shown by 1912 over the previous year; and the later curves give some indication of the principal directions in which business has fallen off.

It is, of course, impossible to accurately forecast the trend of events during 1914, and it may be that the recession in business indicated in our curves, is of a temporary nature. As, however, it is accompanied by a revival of activity on the part of certain importing countries, which have until recently been too busily employed in other directions to devote much attention to the British market, it may be assumed that in the electrical as in other branches of trade, the tendency at the moment is towards restricted business and increasing competition in the world's markets.

Electrical Contractors' Association.—The annual dinner of the Newcastle-on-Tyne branch of the Electrical Contractors' Association was held in the Royal Turk's Head Hotel, Newcastle, on the 17th inst. Mr. J. R. Usher presided, and proposed the toast of "The Electric Supply Authorities," to which Mr. L. E. Buckell, of the Newcastle-on-Tyne Electric Supply Co., responded. Mr. Alan G. Robson gave "The Electrical Contractors' Association." Mr. T. H. Webb, the president, in replying, said that among the many advantages of the Electrical Contractors' Association not the least important was the social element, which, together with the monthly branch meetings, brought competing contractors into friendly relationship with one another. It was necessary for the well-being of electrical contractors that they should gather together in such a way to deal with the questions and difficulties arising in their trade through municipal trading in electrical matters, manufacturers' organisations, and Trade Unions. If there were no Electrical Contractors' Association, no brake could be put upon municipal trading in the matter of electrical wiring, &c. A wiring department of a Corporation could never be an advantage to a municipality, and the Committees and Councils who voted for such schemes were principally men not versed in such matters. The Association also carefully watched the interests of the trade in connection with Parliamentary Bills, and had been rewarded by having clauses deleted from Corporation Bills which would, if carried, have promoted rate-aided competition against electrical contractors. Mr. Robert Robson, when proposing the toast of "The Kindred Electrical Trades," mentioned that the Association as individuals had greatly benefited by the agreement which was made with the Cable-Makers' Association. Mr. W. J. Heads replied.

A New Electrical Fertiliser.—It is reported from Iceland that a German firm has now under construction a factory at Haffradir, in the neighbourhood of Reykjavik, for the manufacture of a new fertilising material with potassium as one of its chief components. The raw material consists of a kind of potassium-feldspar, resembling lava, which will be reduced in electrical furnaces together with coal and iron. The products from these furnaces consist of two kinds, viz., a silicious iron, which is easily saleable to steel works, and a potassium slag, which is first subjected to a crushing process, and then brought into the market under the name of Elektro-Kalium, as an artificial manure. It is stated that the same firm already has a similar factory at work in Italy. The process has been invented by a Swedish engineer, Mr. Axel Lindblad, who has a factory of his own in Sweden, viz., the Sansta Electrical Melting Works at the Hägge Station. Elektro-Kalium is quite a new material, and is not to be confused with the material that has been brought into the market in Germany under the name of Feldspar Flour, and consists of crushed feldspar.

Aluminium in 1913.—The report for 1913 of the Berlin firm of N. Levy & Co. refers, in addition to other metals, also to aluminium, which is stated to have been in great demand for the United States motor-car builders in the first half of the year. The large exports resulting therefrom to the United States entirely cleared the European market of stocks, so that the price in the open market advanced by up to 10s. per cwt. above the official quotation of the international syndicate, which was £4 1s. per cwt. The use of aluminium is making visible progress for all branches of industry, and does not remain restricted to the motor-car, electricity, military and domestic utensils. At the end of 1913 inconsiderable stocks were in the hands of merchants in consequence of sales having slackened and of resales on the part of the Americans, which were effected at a price slightly less than that of the syndicate quotation.

Entrance Scholarships.—An examination will be held at Faraday House Engineering College, beginning on Wednesday, April 1st, 1914, for one "Faraday" Scholarship of the value of 50 guineas per annum, tenable for three years, and for one "Maxwell" Scholarship of the value of 50 guineas per annum, tenable for two years. Full particulars can be obtained from the Secretary, Faraday House, Southampton Row, W.C.

OVERHEAD WIRE CONSTRUCTION FOR MEDIUM AND LOW PRESSURES.*

By A. P. TROTTER.

Electric supply by overhead wires may be roughly divided into two branches, transmission of power to sub-stations, and distribution to consumers or for street lighting. In this country the former is almost always three-phase supply at about 6,000 or 10,000 or 20,000 volts. The routes of such transmission lines are across country, and in general sparsely inhabited districts. It is not proposed in this paper to deal with high pressure work.

Distribution to consumers was carried out at first for the most part by continuous current two-wire or three-wire, but recently there has been a good deal of three-phase or three-phase four-wire work. The voltage between phases is generally at medium pressure, about 440, and the voltage to earth or to the fourth wire about 250. The routes of such lines are generally along streets or suburban roads. There are many examples of towns where the whole of the supply except for the street-lighting of tramway routes is by underground mains. The first case of this kind that was officially authorised was at Keighley in 1904.

Two-wire distribution is generally confined to small towns or villages.

In a few cases power is supplied from tramway trolley wires, and the suggestion has been made that the wires should zig-zag, crossing at each span, the earthed negative being below the positive, to give some chance of a shut down in case of breakage of a positive wire.

The three-wire system is generally used for more extensive continuous current work. Seeing how few cases of injury by electric shock are caused by the fall of trolley wires at 500 volts, the risk of accident due to the breaking of a wire carrying continuous current at a pressure not exceeding 250 volts from earth is not serious, but it may be entirely prevented by splitting the neutral into two wires and providing between these two cross wires in each span, so that a positive or negative wire if broken may be effectually earthed.

This method was described in the early Board of Trade Regulations for low pressure overhead wires as follows:—

> Where a supply is given by overhead wires on the three-wire system, the positive and negative conductors shall be placed side by side above the intermediate conductor. The intermediate conductor shall consist of two wires placed side by side at a distance apart greater than that between the positive and negative conductors, and connected in each span by two cross wires placed in such a manner that in the event of either the positive or negative conductor breaking it shall fall on one at least of the cross wires.

The Board of Trade Regulations for medium and low pressure overhead lines are made for continuous current supply at a voltage not greater than 650 from earth, which is intended to include the maximum drop on an overhead tramway feeder, and for alternating current supply at a voltage not exceeding 250 from earth.

It has been assumed for many years that a fatal shock could not be caused by alternating current at 250 volts unless a large surface of metal could be touched, and it may still be held that the risk of a fatal shock at 250 volts alternating is not great. But the wide use of electric lighting and power multiplies the chances, and four fatal accidents and one nearly fatal have resulted from touching broken wires at about 250 volts or less, that is to say, the wires of 400 or 440 volt three-phase circuits. In three of the fatal accidents the middle point was earthed and in the fourth no intentional earth had been made on the system.

It is therefore necessary that precautions shall be taken to render harmless a broken conductor of an alternating current overhead wire circuit. Minimum-current circuit-breakers cannot be relied upon, balanced protective devices would be too expensive, and the only method seems to be the one suggested in a regulation which appears as No. 6 of the latest code of medium and low pressure overhead wire Regulations of the Board of Trade. This regulation combines the two-wire zig-zag mentioned near the beginning of this paper, the regulation already quoted, and covers three-phase four-wire work. It runs as follows:—

> Where one conductor of an overhead line is connected with earth, the other conductor or conductors shall be arranged in such a manner that in the event of breakage of an unearthed conductor it must fall on the earthed conductor or on wires connected thereto.

Hitherto no regulation had been made which was specially applicable to three-phase four-wire work.

So far as I am aware, the earliest example of continuous current three-wire supply on this method was carried out by Mr. Reginald Wilson at Dudley at the end of 1906. Fig. 1 shows the arrangement, and the next figure shows the additional structure required for carrying guard wires.

In the following year the same method was used by Mr. C. J. Wood, at Sale, Cheshire, Fig. 3. In this example a single cross arm is used and the insulators for the neutral wires are of a very simple pattern appropriate for the small voltage from earth.

In 1910 or thereabouts, it was suggested by Mr. Harold Gray of Accrington that the neutral wires should be placed at a level higher than the positive and negative wires, and that they might be used as guard wires. The arrangement has the advantage that the cross wires form a deep pocket which is much more likely to catch a live wire than the arrangements shown in Figs. 1, 2 and 3. The Board of Trade Regulation was amended in 1911 by the omission of the word "above the intermediate conductor."

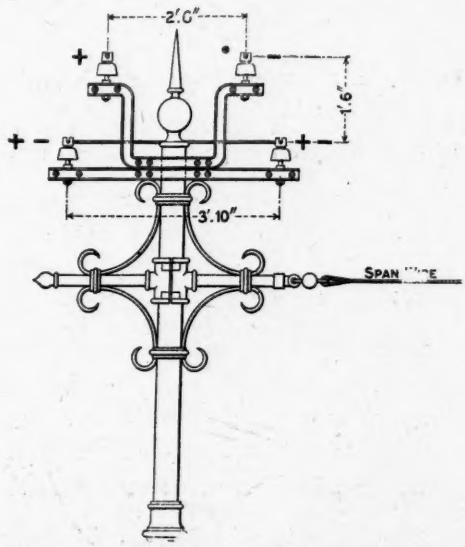


Fig. 1.—Mr. Reginald Wilson's Design at Dudley, 1906. The Cross Wire is Placed at about 5 ft. from the Pole.

The regulations have never called for more than two cross wires. These should be placed as far from the poles as can be conveniently reached from a ladder placed against the pole, say 5 feet. If placed too near to the pole a wire might lie on the ground without touching the cross wire. If

* Paper read before the Institution of Post Office Electrical Engineers, London, January 20th. The copyright is the property of the Institution.

placed too far, the wires swaying in the wind are liable to touch the cross wires.

For tramway spans of 120 feet it is found that 6 or 8 inches is a suitable distance horizontally be-

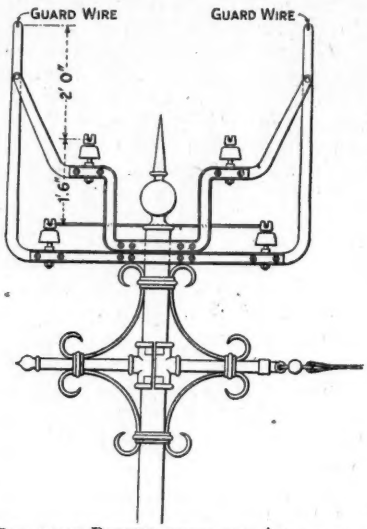


FIG. 2.—THE SAME DESIGN WITH THE ADDITION OF GUARD WIRES.

tween two live wires, but Mr. Harold Gray finds that in the case of a live wire and a switch wire, as shown in Fig. 4, a distance of $3\frac{1}{2}$ inches may

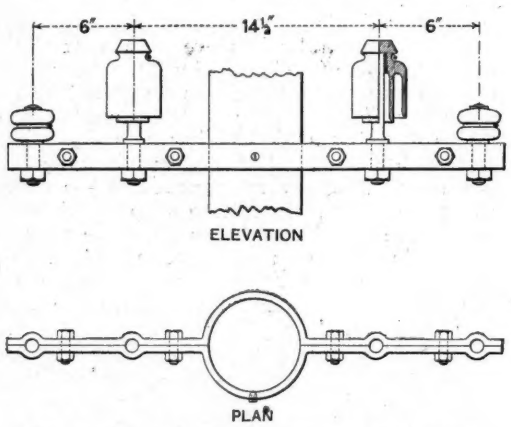


FIG. 3.—MR. C. J. WOOD'S DESIGN AT SALE, 1907.

be used. The method of controlling the street lighting at Accrington from a central point is of

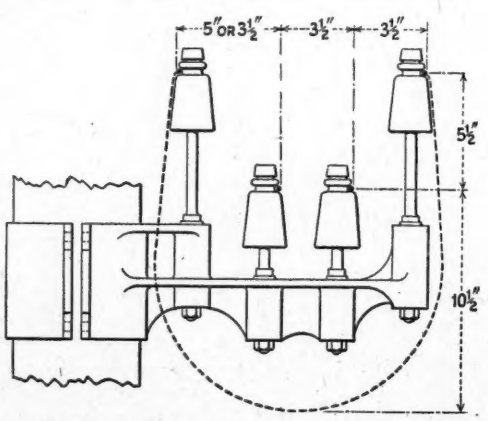


FIG. 4.—MR. HAROLD GRAY'S DESIGN AT ACCRINGTON. STREET LIGHTING. ONE LIVE WIRE, ONE SWITCH WIRE, AND TWO NEUTRALS.

interest, and may be mentioned here though it is somewhat beyond the scope of the present paper. The street lighting wires diverge from a central point and these are switched on for the first half mile. The last lamp operates a switch which puts on the next half mile which is supplied from an underground distributor. The last lamp of this half mile switches on the next half mile and so on. The whole system is controlled from one point, but each half mile is supplied from an independent distributor.

At Rawtenstall Mr. C. L. E. Stewart has applied this system to street lighting circuits by continuous current at 230 volts to earth on tramway routes. In his first design the outer neutral insulators were mounted on long spindles, and the cranking of the arm to avoid this (Fig. 5) was suggested by Mr.

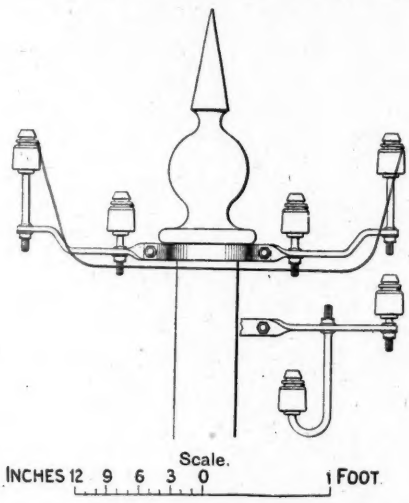


FIG. 5.—MR. C. L. E. STEWART'S DESIGN AT RAWTENSTALL, 1913, FOR TRAMWAY POLES, WITH INSET SHOWING AN ALTERNATIVE METHOD WITH A J SPINDLE.

A. J. Stubbs of the Post Office. But at Rawtenstall the tramway poles are sometimes set back in cross streets to avoid obstruction of the pavements of the tramway thoroughfare. Here it is necessary to carry the lighting wires on the span wires. Fig. 6 shows the arrangement he has devised. The span wire is cut, and a double bar, $1\frac{1}{4}$ in. $\times \frac{1}{4}$ in. is inserted,

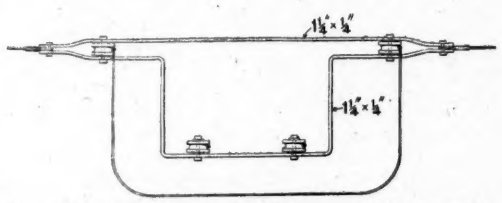


FIG. 6.—MR. C. L. E. STEWART'S DESIGN AT RAWTENSTALL FOR SPAN WIRES.

carrying the neutral insulators. Experience has shown that with the conditions of Rawtenstall these insulators have been sufficient to give satisfactory results with 230 volts to earth, in spite of the absence of any dry shed.

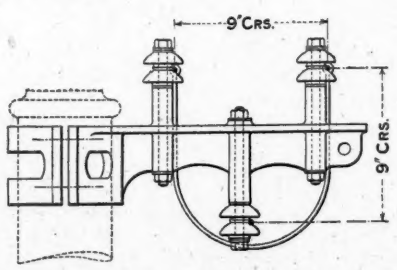


FIG. 7.—MR. H. B. HARVEY'S "TWO-WIRE" DESIGN.

Fig. 7 shows a design which has been made by Mr. H. B. Harvey for a two-wire circuit for street

lighting, but which has not yet been carried out. One of the upper wires is a neutral, which is of course earthed at the station, and the other, which is also earthed at the station and at intervals along the route, is an earth wire for earthing the brackets and tramway poles. The type of insulator is of interest, it is a shackle insulator of stock pattern, mounted on a bolt.

Fig. 8 is a design by the same engineer, the two upper wires being neutrals, and the lower ones live wires.

The Post Office requirements for guard wires, as settled with the Board of Trade in 1905 are well

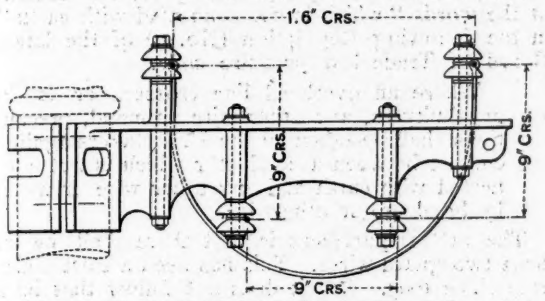


Fig. 8.—Mr. H. B. Harvey's "Three-Wire" Design.

known to tramway engineers, and are intended for the protection of telegraph and telephone wires against trolley wires of at least No. O gauge, carrying heavy currents at 500 to 550 volts from earth. But at the end of the document as issued

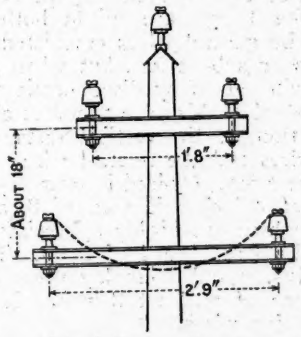


Fig. 9.—A Three-Phase Four-Wire Design.

by the Post Office it is provided that "other methods of guarding proposed by Undertakers will be considered, and, if found suitable, will be accepted." The Dudley, Sale, Accrington, Rawtenstall and

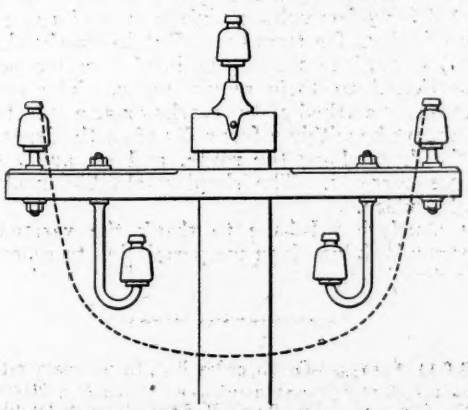


Fig. 10.—A Three-Phase Four-Wire Design with a Single Arm, adopted by Messrs. Strain & Robertson for the Clyde Valley Electrical Power Co.

other examples have been sanctioned in this way.

Fig. 9 shows an obvious mode of construction for three-phase four-wire work, and Fig. 10 is a design which saves the use of a second arm and gives a deep pocket. Guard wires for telegraph and telephone lines are not provided in these and the following cases, public safety against broken wires being the object. In using the arrangement shown in Fig. 10 at an angle pole, care must be taken that the "J" spindle shall pull away from the wires, if it faces the side pull it may twist round. This design is being adopted by Mesrs. Strain and Robertson, for the Clyde Valley Electrical Power Co.

The triangular arangement of the phase wires originated with the idea that such a disposition was necessary for the electrical balance of the circuit. This is however of importance, if at all, only on very long lines and for transmission of power at very high voltage.

Some engineers prefer to place the wires in a vertical plane even if a neutral and a switch wire for street lighting make a total of five wires. One reason is to avoid the use of arms, and another

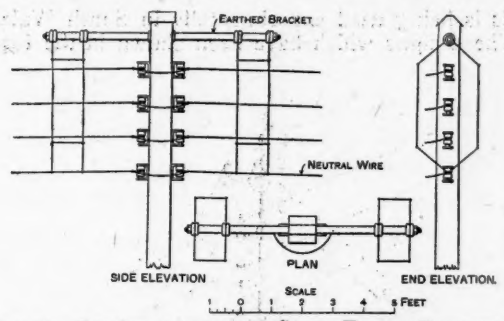


Fig. 11.—Cradle used by the Clyde Valley Electrical Power Co.

is to enable service wires to be led off neatly from the mains. The methods shown in Figs. 9 and 10 cannot be applied.

A form of cradle (Fig. 11), used by the Clyde Valley Co., has suggested a modification which may be called a triangle guard. It may be applied to wires set in a vertical plane in several ways. These triangles are of the nature of the cross wires, which have been described, rather than guard wires, but they may conveniently be called triangle guards.

Fig. 12 shows a three-phase four-wire line constructed by Mr. E. M. Hollingsworth at St. Helens.

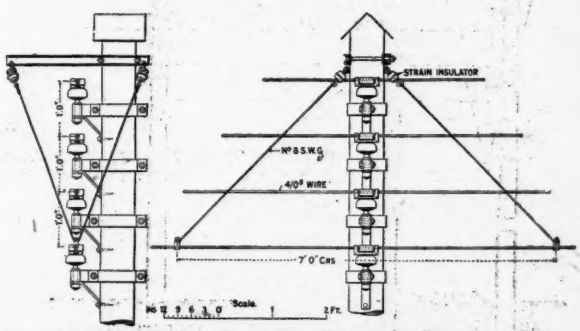


Fig. 12.—Three-Phase Four-Wire Triangle Guarding Constructed by Mr. E. M. Hollingsworth at St. Helens.

The fourth wire is run at the bottom. The triangle wires are insulated from the cross arm for the purpose of carrying out the regulation that a circuit shall be earthed at one point only. As there is no pull on the triangle wires it is rather difficult to make them straight and tidy. In order to tighten the triangle, the fourth wire might be held down as shown in Fig. 13.

A modification of the triangle guard is shown in Fig. 14. A short bracket is used at the top, and a cross arm of equal length is fastened to the fourth wire. The guards become parallel and the clearance is the same for each level. The guards would

prevent the cross arms from twisting. This method has not yet been tried.

A three-phase four-wire design by Messrs. Herbert Lewis and Fletcher, employing triangle guards and a split fourth wire acting as guard wires, is shown in Fig. 15. An arm parallel with the line is used to hold out the ends of the triangle wires.

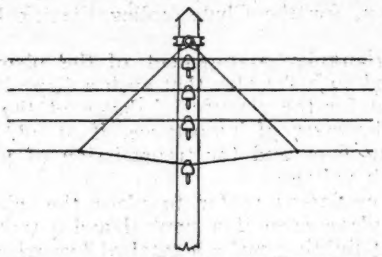


Fig. 13.—Proposal for Tightening Triangle Guards.

This is being used experimentally in South Wales.

The designs which have been shown in the fore-

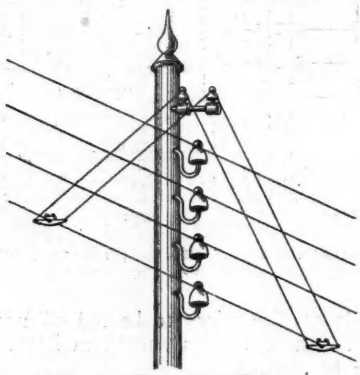


Fig. 14.—Parallel Guards.

going illustrations indicate that the time has come for some detailed requirements for guard wires; and to distinguish them from tramway guard wires the

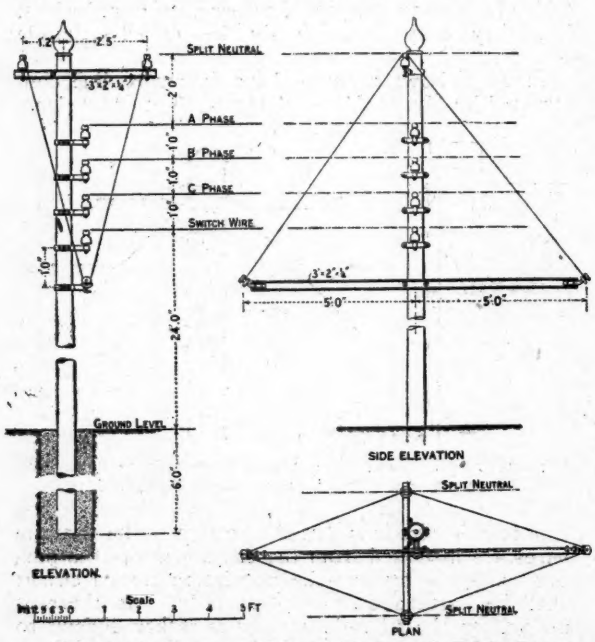


Fig. 15.—Messrs. Herbert Lewis & Fletcher's Three-Phase Four-Wire Design, with Guard Wires.

following conditions may be mentioned. The voltage to earth does not exceed 250. The current used for street lighting circuits does not as a rule exceed 20 amperes. This may be taken as the maximum for the present, and the consideration whether larger currents need be provided for by other regulations may be postponed until occasion arises. The latest code of Board of Trade overhead wire regulations for medium and low pressures fixes the minimum size of wires at No. 11½ S.W.G., or 200 lbs. per mile of copper wire. This is for mechanical purposes and is about the same gauge as the German minimum.

With these conditions, the new proposals are that an earthed wire forming the neutral or intermediate conductor of a three-wire system, or the fourth wire of a three-phase four-wire system may be used as a guard wire. Without going into details, this has been recognised by the introduction of the words "which is not connected with earth" in the following Regulation (No. 9) of the latest Board of Trade low pressure code.

> Where an overhead line crosses, or is in proximity to, any other wire or metal, precautions shall be taken by the Undertakers against contact between a conductor which is not connected with earth and any other wire or metal by breakage or otherwise.

The first requirement is that there shall be at least two guard wires. This has been a Post Office rule since 1905. But it does not follow that both of the wires need be neutral conductors. In Figs. 7 and 8 one of them is an earth wire, bonding all ironwork together and putting all the earth connexions in parallel. It has been suggested that one of the wires may be used as a switch wire for turning out part of the street lamps at a late hour. So long as the upper wires are not intended to serve as guard wires this is a convenient arrangement. While all the lamps are alight both the guard wires would be neutral wires connected with earth at the works or sub-station, but when part of the lamps are switched off by disconnecting the return wire with "earth" this wire becomes alive.

The reduction of the vertical distance between the guard wires and the neutral wires to 8 inches instead of the 2 feet required in tramway work, and an overlap of 4 inches instead of 8, are valuable concessions which are highly appreciated by those engineers who have heard of them. The designs shown in Figs. 7 and 8 employ these dimensions, and a distance of at least 8 inches is maintained between the live wires.

In triangular guarding and in Fig. 10 the clearance between the guard wires and the lowest phase wire seems to be small, but it must be remembered that the guards are near the poles and the swing of a wire is very small there.

Manufacturers of underground cables have always professed to be unable to provide an insulation adapted for a few volts, as in the case of a negative return feeder of a tramway. But in overhead construction engineers can use insulators reasonably proportioned to their requirements. The neutral wires being earthed at the works or at a sub-station will always be within a few volts of earth, depending on the drop along the route, and on any out of balance currents. The simplest shackle insulators should suffice.

In conclusion I have to thank the various engineers who have given me permission to reproduce their drawings.

10,000 Motors.—On Saturday last, to commemorate the completion of their ten-thousandth electric motor, Messrs. E. Brook, Ltd., of Colne Road, Huddersfield, entertained their employés to a dinner and dance. About 160 guests were present, of whom 100 were employés. The output of the works is now at the rate of 2,000 per annum. The firm has been engaged in motor manufacture for the past 10 years, and to-day it has branches in a number of the more important cities in England, as well as in Canada and New Zealand. Alderman E. A. Beaumont (the auditor) proposed the health of the chief of the firm (Mr. E. Brook), who replied, cordially alluding to the support received from managers, staff and workpeople in the development of the business.

SOME LIMITING FACTORS IN ELECTRIC RAILWAY ENGINEERING.

By E. V. PANNELL.

In almost every country having a railway system of any magnitude the problem of electric trunk-line operation is being seriously considered. The technical possibilities have been thoroughly demonstrated on such schemes as the New York Central and New Haven Railroads in America, the two electrified sections of the Prussian State Railways in Europe, and the Lancashire and Yorkshire Railway in this country. The great disparity between constructional and operating conditions in different countries makes the financial question still a very open one, and it is almost impossible to generalise in this matter. So many variable factors enter into the estimate that it is quite impracticable to attempt to predicate the success of an electric railway worked on any one or other system in this country from the satisfactory operation of a similar line in, say, Germany or the United States. From the engineering point of view, however, it is quite possible to predict and to solve the problems which will arise in practice. It is a far easier matter to predetermine the speed and tractive effort of an electrically-propelled train under given conditions than to make a similar computation for a steam locomotive. This simple fact renders it possible to foretell the limiting sphere of utility of electric traction for any given set of circumstances.

The keynote of any such radical change as the adoption of electric working on a steam railway is *service*. The growth of population and trade demand, year by year, increased service facilities, but it is only where the limits of the present type of propulsion are in sight that the consideration of any other system becomes justified. In other words, there is no logical reason for the installation of electricity on main lines except where the service has become beyond the capacity of steam haulage, either in the matter of speed or tractive effort. Certain special conditions do sometimes dictate the use of electric working, as for instance, the operation of long tunnel sections, but these do not come under the heading of main line operations properly so-called. Admitting as an axiom, therefore, the statement that the use of electricity is to extend the limits of steam working, there are two means by which this can be effected; either by a general increase in the schedule speed or by augmenting the average weight of trains to be hauled. As a matter of fact, the requirements of service are increasing so enormously that it will be necessary to consider the extension of both these factors. It is, however, of particular importance to ascertain the practical and economic aspects of running speeds appreciably in advance of those indicated by present day time-tables.

Considering the actual work done by a locomotive or motor-car in hauling a train, the energy is found to be made up of two factors, speed and tractive effort, both of which are limited externally by the permanent way, and internally by the capacity of the driving motors. In cases where it is proposed to substitute electric for steam haulage the internal limits will be extended, but the permanent way will continue to exert the same influence. Economic considerations in most cases preclude complete track renewal, so that electricity must be able to show improved service on the same permanent way as at present laid down for steam traction. This track limitation is a very serious one, and is due mainly to the shocks communicated to the rail joints by the wheels of a heavy locomotive when running at high speed. Added to this is the trouble of "nosing," by which is understood a lateral movement of the locomotive tending to spread the gauge. Lastly, in this connection are the effects of centrifugal force on curves; where the centre of gravity is high (as in modern steam locomotives) the tendency is for the inner wheels to leave the track, and for the whole machine to tilt over outwards. When, however, the mass is centred low down, this centrifugal action is manifested as an exaggerated "nosing," and the gauge may suffer from the enormous pressure exerted by the flanges of the outer wheels. Super-elevation and guard rails are, of course, used to overcome these difficulties, but only to the extent called for by moderately high speeds. Excessive super-elevation cannot be resorted to, as being dangerous for slow trains passing around such curves.

These remarks apply mainly to running around curves, and on straight track the centrifugal action, of course, disappears. Where the permanent way is straight and level, and where, as in this country, it consists of heavy bullhead rails laid in chairs, the limiting factor of the speed is, with steam propulsion, the locomotive. The efficiency of the steam locomotive falls off very rapidly with increasing velocity. Typical characteristics of steam and electric locomotives are shown in fig. 1, and it will be

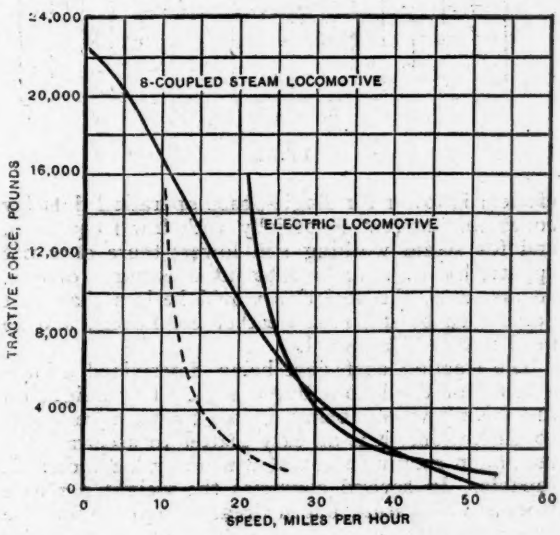


FIG. 1.

noted that above a certain speed the tractive effort of the steam engine drops down to vanishing point, whilst that of the electric locomotive droops at a much lower rate. This comparison is not a strictly quantitative one, as the two types of locomotive were designed for different classes of service; the forms of curve are, however, quite typical of the two methods of propulsion, assuming the electric motors to be of the series type having highly saturated magnetic circuits. Performance under service conditions shows the effect of this disparity; an extra heavy load or an adverse grade will pull down the speed of the steam-propelled train to a much greater extent than will be the case with the electric train, consequently the latter will keep better time under such unfavourable conditions. In other words, electricity fulfils the requirement of *service* more completely than is done by steam. This is more particularly true in the present instance, where it is desired to extend the speed limits. To secure high running speeds with steam locomotives, large diameter driving wheels have to be employed in order that the piston speed may not exceed judicious limits. This, however, reduces the available tractive effort, and it is found that the maximum weight of train which can be hauled by a steam locomotive falls off very rapidly with increasing velocity.

Treating of the other factor of locomotive out-

put, *i.e.*, tractive effort, this is effected by several external influences which are quite independent of whether steam or electric operation be employed. The ruling quantity is here the value of the tractive coefficient expressed as a fraction of the weight upon the driving wheels. Different values for this quantity have been subscribed by different observers, but it is believed that the curves shown in fig. 2 represent average figures for normal track conditions. It has been asserted that the traction co-

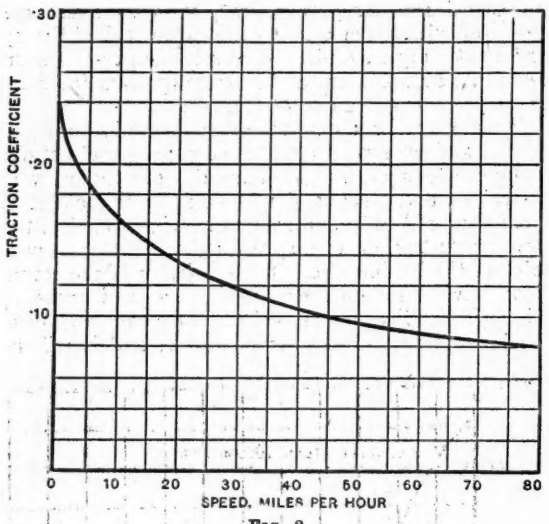


FIG. 2.

efficient is lower for single-phase operation than for continuous-current (especially with low frequency), and for steam working still lower; there does not appear, however, to be substantial evidence of this. At any rate, the variation would be less than that occasioned by different weather conditions, and so need not be considered.

The traction coefficient being determined affords a basis for the locomotive design. The weight on the driving wheels being limited by permanent way considerations, it is an easy matter to ascertain the maximum tractive effort of which any locomotive is capable. In several countries the weight per axle is limited by statute, but in Great Britain the practice varies on different systems. Good average practice is represented by the following table:—

LIMITING VALUES OF TRACTIVE EFFORT.

Speed, M.P.H.		20	30	40	50	60	70
Traction coefficient		0·14	0·12	0·10	0·095	0·09	0·085
No. of axles.	Adhesive weight, lb.	Tractive effort, lb.					
1	44,800	6,280	5,370	4,480	4,250	4,030	3,810
2	85,000	11,900	10,200	8,500	8,080	7,650	7,220
3	121,000	17,000	14,500	12,100	11,500	10,900	10,300
4	152,000	21,300	18,200	15,200	14,500	13,700	12,900
5	179,000	25,000	21,400	17,900	17,000	16,100	15,200
6	202,000	28,300	24,200	20,200	19,200	18,200	17,300

The table also sets forth the maximum tractive forces which can be exerted by locomotives of different types. These figures are based upon the curves in fig. 2. This reasoning brings us to an important conclusion, viz., it shows exactly the maximum tractive effort which can be obtained from a locomotive of a given number of driving axles at any speed.

Having discussed the limiting mechanical forces which the locomotive can be designed to yield, it remains to consider the resistance which has to be overcome. Data on tractive resistance have of recent years been largely augmented by the valuable contributions of Aspinall, Davis, Carter, and others. Unfortunately, few experimental values have been obtained at very high speeds, consequently the estimation of tractive forces above 70 miles per hour becomes to some extent a matter of conjecture. The writer has used Aspinall's tests for the calculation of the curves in fig. 3, and it is believed that these figures are more reliable than those from other sources, as they refer solely to British permanent way and rolling stock.

Little use can be made in this country of results obtained in America, owing to the great disparity

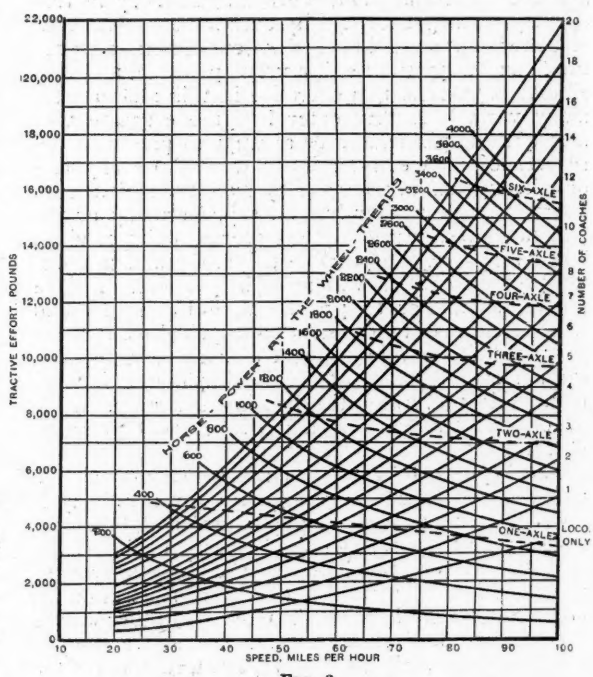


FIG. 3.

in the weight and size of coaches, type of permanent way, etc. A standard form of coach has been assumed in the present investigation, having a length of 60 feet and a loaded weight of 35 tons. Allowance has, of course, been made for the effort required to propel the locomotive itself, so that the forces shown in fig. 3 are those obtaining at the driving wheels, and not merely the drawbar-pull. Three sets of curves are incorporated in the diagram; (*a*) the rising lines showing the relation between tractive force and speed for different lengths of train; (*b*) the drooping hyperbolic curves, each of which represents a given horse-power at the wheel-treads; and (*c*) the dotted lines which represent the maximum capacity of the locomotive before slipping takes place. From this diagram can be seen at a glance the maximum number of coaches which can be handled by a locomotive of any given horse-power and number of axles. As already pointed out, these figures refer to average weather conditions, with a bias towards the unfavourable, so that it may safely be assumed that these results will hold for the greater number of days in the year. Under conditions embodying greasy rails, heavy side winds or adverse signal conditions (all of which troubles generally come together), a lower schedule speed and higher power consumption are inevitable. It will be noted from fig. 3 that for all heavy railway work, locomotives of 4, 5, or 6 driving axles must be employed in order to get the necessary tractive effort for the haulage of long trains. This is borne out in present-day practice, as the most recent designs go to show. Presuming that average running speeds of 80 to 90 miles per hour were to be adopted, it would be necessary to use locomotives of 5 and 6 axles to haul trains of 12 to 16 coaches.

whilst the power exerted per train at the wheel-treads would be about 3,400 H.P.. Considering, however, a speed of 60 miles per hour, a smaller locomotive exerting only 1,600 H.P. would suffice. This emphasises the fact that, whatever be the method of traction used, extra high speeds are an expensive luxury, and that the cost of running such trains is out of proportion to the revenue at present obtained therefrom.

Investigation of the matter brings one to the conclusion that if electricity is to be employed to supersede steam to the best advantage, the preferable method will be to give the electric locomotive heavier trains to haul rather than to run it at a very much higher speed. Much could be done by electricity, however, in speeding up the steam trains at present operated on slow schedules.

The foregoing has shown that most of the limiting factors of electric railway operation are limits of locomotive design. The maximum outputs which the weight and friction will permit have already been arrived at, and it remains to consider and compare these with the maximum horse-power which the motors can deliver to the axles. Now, examining a large number of modern locomotive designs, it is found that the weight due to the electrical equipment is always very nearly 50 per cent. of the total locomotive weight. This only fails to hold good in machines of a special type, such as slow-speed or freight locomotives, in which the mechanical parts have to be very heavy to withstand the enormous thrusts and drawbar pulls. On this assumption the table following is based. The adhesive weights are obtained as already described and the *maximum* tractive force under starting conditions is deduced therefrom. Adding to the adhesive weight the necessary tonnage to be placed upon the leading and trailing pony trucks, the total weight is arrived at, half of which is apportioned to the electrical equipment. The horse-power per ton of equipment is a fairly well-defined figure, except that it is often confused by the ambiguity as to the method of rating used. In the present instance, by "output" is understood the horse-power which the motor can maintain continuously with a maximum ultimate temperature rise of 60 deg. C. on the hottest part.

LIMITING OUTPUTS OF ELECTRIC LOCOMOTIVES.

No. of axles	2	3	4	5	6
Adhesive weight, lb. ...	85,000	121,000	152,000	179,000	202,000
Max. tractive effort, lb. ...	17,000	24,200	30,400	35,800	40,400
Do. with sand, lb.	28,000	40,000	50,100	59,000	66,500
Wheel arrangement ...	2-4-2	2-6-2	2-8-2	2-10-2	2-6-6-2
Non-adhesive weight, lb. ...	54,000	54,000	54,000	54,000	54,000
Total weight, lb.	139,000	175,000	206,000	233,000	256,000
Total weight, tons	62	78	92	104	114
Weight of frame, housing, &c., tons	31	39	46	52	57
Do. elec. equipment, tons	31	39	46	52	57
Continuous output (continuous current) H.P.... ...	950	1,200	1,400	1,550	1,700
Do. (single-phase) H.P.	620	800	920	1,050	1,150
Estimated cost of loco. ...	£5,000	6,200	7,300	8,300	9,100

From the above it will immediately be noted that the maximum output of the motors is far below the dynamical limits of the locomotive, as shown in fig. 3. This affords the chief reason for the adoption of forced draught ventilation on motors of this type. With naturally ventilated motors the locomotive cannot run up to more than about 50 per cent. of its dynamical capacity, and it will be limited by its electrical equipment; to make the most efficient use of a given locomotive—it should be run at the speeds and loads shown in fig. 3 as nearly as possible.

B.E.A.M.A.—At the Council meeting of the Association, held at King's House, Kingsway, on the 15th inst., the following firms were elected members of the Association:—Bray, Markham and Reiss, Ltd., W. T. Glover & Co., Ltd., Siemens Bros. & Co., Ltd.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

NEW ZEALAND.—The Customs authorities have decided that the duty on electric hot-air blowers and vibrators shall be 20 per cent. *ad valorem*. The duties quoted are those leviable under the lower tariff applicable to British goods; the duty on foreign goods of the same kind is 30 per cent. *ad valorem*.

SOUTH AFRICA.—The Trade Commissioner in South Africa has forwarded to the Board of Trade certain further rulings which have been given to the Cape Town Chamber of Commerce with reference to the valuation of goods for import duty purposes, and the declaration on invoices.

The Commissioner of Customs has informed the Chamber that a circular has been issued which lays down special provision in the case of goods which are manufactured solely for sale in the South African market. The certificate, which will be accepted by him, is to the following effect:—

"That goods specified under invoice No....., dated..... herein, in the name of Messrs....., are manufactured solely for the South African market, and there are no similar goods sold for use in the country of manufacture, and we hereby declare the values to be calculated at rates and discounts which would apply if the goods were sold for home consumption in that country."

The Cape Town Chamber raised a further point in regard to duty being levied upon railway carriage to the port of shipment. The law lays down that the "home consumption value" must be the value at the place of purchase, and the Commissioner was asked as to whether it is legal or not to deduct the amount of the railway carriage on goods shipped at European ports for the Union of South Africa.

The Commissioner stated that the value of an article for Customs purposes is its open market value at the place of purchase, and it follows, therefore, that when the price of any article for export at the port is the same as that for home consumption in the country of origin, the invoice value of such goods, without any deduction for railway carriage, is that on which duty is leviable, always provided that the price is not less than that at which the article is sold for home consumption. When a charge over and above the price of an article at the place of purchase is made by bringing it to a port of shipment, such charge is not included in the value for Customs assessment purposes.

If, therefore, an importer wishes to be allowed to deduct any sum included in the price of an article, being included therein to cover f.o.b. charges, he must be able to prove that if the article in question were sold for home consumption at the place of purchase, the price he would have paid would have been less the cost of the f.o.b. charges.

WEST INDIES.—The provisions of the Canada-West Indies Treaty, which, as previously notified in the ELECTRICAL REVIEW, gives a preferential duty on British and Canadian goods imported into certain West Indian islands, have been extended to Grenada. It is understood that the amount of the preference to be granted in Grenada will be one-fifth of the ordinary duty leviable under the tariff.

Wireless Telegraphy on the Quenched-Spark System.—We have received from MESSRS. SIEMENS BROS. AND CO., LTD., a copy of their revised pamphlet, A 550, dealing with their quenched-spark wireless installations for ships. The manufacture of this apparatus was taken up by Messrs. Siemens Bros. and Co. at their works at Woolwich in 1911, and the progress which it has made in England is shown by the fact that there are now over 90 British vessels fitted. Of special importance is the fact that with quenched-spark installations no sound-proof cabin is necessary, any suitably situated cabin being able to accommodate the apparatus. Another important advantage with this system is that twice as much energy is radiated by the quenched spark as by the open spark, and with quenched-spark radiations the electrical oscillations, on conversion to sound waves in the receiving station, give rise to a musical note, which can be heard over natural electric discharges or "atmospherics," even when these are as much as 10 to 15 times as intense as the incoming signals. The latter part of the pamphlet contains brief specifications and illustrations of the principal types of marine wireless telegraph stations, from the smallest type of station, intended for use on launches, up to stations with a guaranteed range of up to 550 miles. This is considerably larger than the stations usually installed upon even the largest mercantile vessels. A large Naval station having a range guarantee from 800 to 2,000 miles has recently been delivered to a foreign Government, which since delivery has placed the order for two more stations of the same type, but with various improvements, which are now being built at Messrs. Siemens Bros. & Co.'s Woolwich works. The pamphlet is well illustrated throughout, and contains photographs of vessels of various types showing the extent to which this system has been adopted on board ship.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

226. "Electric furnaces." I. RENNERFELT. January 5th. (Convention date, January 4th, 1913, Sweden). (Complete).

231. "Suspenders for electric cables and the like." P. HUNTINGTON. January 5th.

252. "Relay arrangements for wireless telegraphy and telephony." G. G. VON ARCO and A. MEISSNER. January 5th. (Complete).

253. "Dynamo-electric machine." R. H. LANE. January 5th.

284. "Anode of hard lead for electrolytical purposes." E. C. R. MARKS. January 5th. (Siemens & Halske Akt. Ges., Germany). (Complete).

285. "Electrodes for metal-vapour rectifiers or the like. AKT. GES. BROWN, BOVERI ET CIE. January 5th. (Addition to 186/14. Convention date, July 10th, 1913, Germany). (Complete).

299. "Devices for breaking alternating-current commutator motors." SIEMENS-SCHUCKERTWERKE G.M.B.H. January 5th. (Convention date, January 4th, 1913, Germany). (Complete).

310. "Telephone systems." E. A. GRAHAM. January 5th. (Complete).

311. "Telephone systems." E. A. GRAHAM and W. J. RICKETS. January 5th. (Complete).

313. "Commutator switches." H. WADE. January 5th. (C. KAISSER, Belgium). (Complete).

318. "Water-motor mounted upon or between a floating deck or decks, for the purpose of driving an electrical generator." J. DENT. January 6th.

340. "Switches." G. W. HART. January 6th. (Complete).

341. "Reversible electric motors." G. W. WARNHOLZ, F. M. SPENCER and W. J. WIGMORE. January 6th. (Complete).

357. "Sparking plugs." O. FREIBERG and O. PETZSCHE. January 6th. (Convention date, October 8th, 1913, Germany). (Complete).

361. "Recovery of copper from weak copper-sulphate solutions." S. O. COWPER-COLES. January 6th.

362. "Process for the treatment of ores containing iron and copper." S. O. COWPER-COLES. January 6th.

363. "Process for the manufacture of metallic strips and ribbons." S. O. COWPER-COLES. January 6th.

364. "Electro-deposition of alloys." S. O. COWPER-COLES. January 6th.

365. "Process for coating metal plates and the like." S. O. COWPER-COLES. January 6th.

366. "Construction of pipes." S. O. COWPER-COLES. January 6th.

373. "Electric apparatus for heating liquid." J. VON HENTZEL. January 6th. (Complete).

389. "Fuses for electric circuits." SIEMENS-SCHUCKERTWERKE G.M.B.H. January 6th. (Convention date, May 10th, 1913, Germany). (Complete).

390. "Dynamo-electric machines." BRITISH THOMSON-HOUSTON CO., LTD., and A. A. POLLACH. January 6th.

391. "Electric switching systems." BRITISH THOMSON-HOUSTON CO., LTD. and H. C. HASTINGS. January 6th.

399. "Submarine telegraphy." J. S. WITHERS. January 6th. (K. C. COX, Norfolk Island).

402. "Means for and methods of protecting alternating current electric generators." A. M. TAYLOR. January 6th.

412. "Electric switch." MICKELWRIGHT, Ltd., W. W. PECK and W. R. MICKELWRIGHT. January 7th.

415. "Gas-controllers and the like." E. H. HORSTMANN, G. O. H. HORSTMANN, A. HORSTMANN, S. A. HORSTMANN and W. T. EDGAR. January 7th.

427. "Distance gas-lighting apparatus, for switching on and off electrically, and means for igniting same." H. T. BROOKER and H. BROOKER. January 7th.

440. "Call-up switch for wireless telephones." P. A. E. ARMSTRONG. January 7th.

441. "Mercury breaks or interrupters." H. F. BIGGS and F. R. BUTT. January 7th.

450. "Semi-automatic or automatic graded service telephone systems." H. BARON. January 7th. (G. Heimann, Germany). (Addition to 11,888/13). (Complete).

452. "Transmitter for distant controlling-apparatus for ordnance." R. GIRARDELLI. January 7th. (Convention date, January 16th, 1913, Italy). (Complete).

455. "Mechanical breaks or interrupters." E. E. GREVILLE. January 7th.

459. "Number impulse instrument for automatic or semi-automatic telephone systems." SIEMENS & HALSKE AKT. GES. January 7th. (Convention date, April 17th, 1913, Germany). (Complete).

460. "Sound-transmitters." W. J. MARCHANT. January 7th. (Complete).

515. "Starting and regulating the speed of dynamo-electric machines." F. CUMONT. January 8th. (Addition to 8,108/12). (Complete).

518. "Safety fuse-plug." C. F. CHRISTENSEN and M. WETTERGREEN. January 8th.

521. "Shade reflectors for electric and other lighting purposes." J. MORRISON and J. MARSDEN. January 8th.

528. "Process for manufacturing condensation products from phenol, formaldehyde, and the like." KONSTANTIN TARASSOFF. January 8th. (Complete).

540. "Electric incandescent lamps." WESTINGHOUSE METALLFADEN GLUHLAMPENFABRIC G.M.B.H. January 8th. (Convention date, January 13th, 1913, Austria). (Complete).

549. "Electrolytic recovery of zinc from solutions of zinc sulphate." E. J. HUNT and W. T. GIDDEN. January 8th.

557. "Improvements in electrical terminals." WESTERN ELECTRIC CO., LTD. January 8th. (F. T. Woodward, of Belgium).

561. "Method and means for determining and adjusting the speed of rotation of impulse-transmitting device for automatic telephone exchange systems." WESTERN ELECTRIC CO., LTD. January 8th. (F. T. Woodward, Belgium).

570. "Electric induction furnaces." J. HARDEN. January 8th. (Complete).

590. "Application of the electric properties of metallic sulphides to electrotechnics." G. MASCARINI and A. CONTARDI. January 8th. (Convention date, January 11th, 1913, Italy). (Complete).

597. "Equipment for producing welded seams by means of the electric arc and added welding-materials." F. W. HEUSER. January 8th. (Convention date, July 29th, 1913, Germany). (Complete).

599. "Devices for supporting and insulating electric conductors." NEVILLE, WILLIAMS & Co. and A. E. WOODHOUSE. January 9th.

600. "Device adapted to produce, in case of coil defects in the armatures of electric machines, an automatic indication of the said irregularity, or an automatic stopping of the machine, or a decrease of its number of revolutions or of its tension." F. V. SCHIODT and W. RUNG. January 9th. (Complete).

624. "Protective devices for dynamo-electric motors. G. ELLISON and M. R. H. MUELLER. January 9th.

628. "Method of construction of electric ovens and the like." G. H. CLARKSON, A. J. H. ANDREWS and D. H. JACKSON. January 9th.

630. "Electrical heating-apparatus." A. E. GRABONSKY. January 9th.

631. "Electrical heating-apparatus. A. E. GRABONSKY. January 9th.

643. "High-speed interrupters or vibrators used in connection with electrically operated devices." F. KNABL. January 9th.

683. "Means for collectively actuating and controlling alternating-current motors." J. L. ROUTIN. January 9th. (Addition to 735/13). (Complete).

719. "Sparking-plugs for internal-combustion engines." F. H. BLUEMEL and BLUEMEL BROS., LTD. January 10th.

728. "Method of and apparatus for treating deep-seated parts of the body with Röntgen rays." E. POHL. (Convention date, March 29th, 1913, Germany). (Complete).

739. "Device for prolonging the period between active intermittent electric impulses." A. B. WEBBER and STANDARD TIME CO., LTD. January 10th.

742. "Apparatus for automatically mixing up baths through which electric currents are conducted by means of electrodes." FRIED. KRUPP AKT. GES. January 10th. (Convention date, January 17th, 1913, Germany). (Complete).

749. "Supports for electric trolley wires. K. VON KANDO. January 10th. (Complete).

767. "Telephonic systems." E. A. GRAHAM and E. A. SANFTLEBEN. January 10th. (Complete).

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

21,743. WIRELESS TELEGRAPH SYSTEMS. W. H. Shephard and A. E. McKechnie. September 24th.

26,800. PROCESS FOR RENDERING NON-DUCTILE METALS DUCTILE. C. Trenzen. November 21st. (August 14th, 1911).

26,899. REGULATION OF ELECTRIC ROTARY CONVERTERS. P. Whitaker. November 22nd.

29,351 to 29,360. TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. (Automatic Electric Co.). November 20th.

29,384. METHOD OF REPRODUCING ELECTRIC VARIATIONS. H. de F. Arnold. December 20th. (July 15th, 1912).

29,416. TELEGRAPHIC RECEIVING APPARATUS ADAPTED TO ACTUATE A PERFORATOR, TYPEWRITER, OR ANALOGOUS DEVICE. A. C. Baronio and K. L. Wood. December 20th.

29,456. ELECTRIC ACCUMULATORS. B. Heap and Chloride Electrical Storage Co. December 21st.

29,461. MEANS AND METHOD OF OPERATING LIQUID ELECTRIC CONTROLLERS AND STARTERS. R. F. Baerlocher and Allen West & Co. December 21st.

29,522. DYNAMO-ELECTRIC MACHINES. Soc. S.T.A.R. (Systeme de Traction Auto-Regulateur). December 23rd. (December 21st, 1911).

29,613. ELECTRIC IGNITERS. F. W. May. December 23rd.

29,620. ELECTRIC IGNITION GENERATORS. B. Lawrence. December 23rd.

29,719. IMPULSE-SENDING MECHANISMS. Western Electric Co. (F. T. Woodward, acting for the Western Electric Co.). December 24th.

29,721. TELEPHONE SYSTEMS HAVING AUTOMATIC SWITCHING APPARATUS CONNECTED OVER JUNCTION LINES WITH A MANUAL EXCHANGE. Siemens Bros. & Co. and T. Pettigrew. December 24th.

29,763. ELECTRIC COOKING AND HEATING APPLIANCES. A. H. Railing and C. C. Garrard. December 27th.

29,809. ELECTRIC COUPLINGS FOR USE IN THE ELECTRICAL INSTALLATIONS OF MOTOR ROAD-VEHICLES AND THE LIKE. H. Lucas and W. H. Edwards. December 27th.

29,879. DETACHABLE ELECTRIC IMMERSION HEATER. G. H. Ide. December 28th.

1913.

4,355. ELECTRIC OZONE GENERATORS. C. W. Denny. February 20th. (Cognate Application, 17,969/13.).

4,638. ELECTRIC TIME-ALARMS. W. Rausch. February 24th.

9,463. EARTHING CLIPS FOR METALLIC COVERED ELECTRIC CABLES. F. de B. Hart and Anchor Cable Co. April 22nd.

9,530. SUBSTITUTION RESISTANCES FOR ELECTRIC LAMPS. H. Heins. April 23rd (October 3rd, 1912).

9,685. AMORTISSEUR WINDINGS FOR SYNCHRONOUS DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. and F. P. Whitaker. April 24th.

10,018. SUBSTITUTION RESISTANCES FOR ELECTRIC LAMPS. W. Heins. April 29th. (Addition to 9,530/13. November 25th, 1912).

13,654. ELECTRIC SWITCHES. E. A. Fagerlund. June 12th. (June 14th, 1912).

13,660. ELECTRIC LIGHTING INDICATOR. J. C. Hutton. June 12th.

24,126. GEARED ALTERNATING CURRENT ELECTRIC MOTORS. Siemens-Schuckertwerke Ges. October 24th. (October 24th, 1912).

24,148. MASTS FOR WIRELESS TELEGRAPHY AND LIKE PURPOSES. Marconi's Wireless Telegraph Co. and A. Gray. October 24th.

Ashes as Fuel.—The amount of carbon in the ash taken from a boiler is rarely less than 10 to 20 per cent., and is frequently much more, especially in cases of forced firing. A process for saving this has been proposed, wherein the ashes are placed in a liquid having a specific gravity greater than that of the coal, but less than that of the ashes, so that the ashes sink to the bottom and the coal floats, both being continuously removed. In a trial of the apparatus, 800 tons of coked coal were recovered from 2,000 tons of ashpit waste. Of this, some 500 tons were in pieces of from ¼ in. to 2 in. in size, while the rest was available for briquetting. The soot carried over to the tubes and back connection is some 60 per cent. carbon, and the New York Edison Co. is investigating the practicability of briquetting it.—*Power.*

Radium in the U. S. A.—Energetic steps are being taken to secure for the public benefit the great deposits of carnotite in Colorado and Utah, from which radium is being extracted. A National Radium Institute has been established, in conjunction with the Bureau of Mines, to extract the radium and to afford facilities for the free treatment of all cancer patients; none of the radium will be sold. Legislation is contemplated to safeguard any sources of radium that may be discovered in the future.